THE THIRD PART OF THE PRINCIPLES OF THE ART MILITARY.

PRACTISED IN THE WARRES OF THE

UNITED PROVINCES

Vnder the LORDS the

STATES GENERALL

And his Highneſſe the

PRINCE OF ORANGE.

Treating

OF SEVERALL PEECES OF ORDNANCE, Carriages, Engines, Quadrants, Morters, Petards, as alſo inſtructions for Maſter-Gunners, and Canoniers, with divers Inſtruments and Materials belonging to a warre with their ſeverall uſes and practiſes, moſt briefly and lively demonſtrated by LETTER and FIGURE.

TOGETHER WITH A LIST OF ALL NECESSARY Preparations appertaining to an Armie, With a Quarter for the Generall of the ORDNANCE, *and of all Officers belonging to his Traine.*

Written and compoſed by *Captaine* HENRY HEXHAM, Quarter-maſter to the truly honourable, Colonell GORING his REGIMENT, for the lovers of the Noble ART MILITARIE.

The ſecond Edition Corrected and Amended.

ROTTERDAM
Printed by JAMES MOXON. 1643.

TO

HIS HIGHNES CHARLES LODOWICK: PRINCE ELECTOVR

COUNT PALATINE OF THE RHENE, AND DUKE OF *BAVARIA.*

SIR,

AFTER I had travelled through the world in ſpeculation, by tranſlating and augmenting of ATLAS MAJOUR in English, dedicated to his moſt excellent Majeſty your Uncle, & my dread Soveraign: I could give no reſt unto my thoughts till I had undertaken ſome thing of my owne profeſſion, which might give light, underſtanding, and inſtruction, unto ſome young Gentlemen, Souldiers and others, who deſire to follow the warres, and to ſtudie this Art Military, for their princes ſervice, and the good of their Country. And where could I find a fitter place, and a better ſubject to worke upon, then in theſe United Provinces, under the command of the Lords, the STATES GENERALL, and his Highneſſe the Prince of ORANGE, which now in regard of their long Wares may truly be called a nurcery, and *ſedes belli*, for the breeding and trayning up of Souldiers, and verily how could I do better then to begin *ad principium*, with the very firſt principles, and rudiments of the Art Military, Practiſed in theſe Warres, under the command, firſt of Prince MAURICE, *of bleſſed Memory*, and now under the able conduct of that great and victorious Captain Generall of our age, his *Highneſſe* the *Prince* of *Orange* his *Brother*. Now beſides what experience my long ſervice hath gayned vnder their Commaund, for the ſpace of fortie yeeres, as an addition thereunto, I have got ſome tranſlations and extracts out of the beſt and choiſeſt Authors of our modern times, who have writ upon this ſubject, to give luſtre unto it. and having before by the aſſiſtance of God, run through the firſt two parts: I have now alſo finished my third part, concerning all preparations and neceſſaries appertaining to an Army, and ſo to put an end unto this laborious work, For in my firſt part I promiſed the right honourable the Earle of Holland, and in my ſecond part my noble Colonel, that I would go through the three whole parts, for the arming of a Souldier, *de cap en pied*, that is at all points, which now thanks be to God I have done, to the end, that ſuch as may go into, his Majeſties ſervice, your Highneſſes, or any other forrain State or Princes, may gaine ſome experience, and reape ſome benefit by my labours, which is, and was the principall thing I aymed at, For I hope, as old as I am, when theſe unhappy differences at home are reconciled, appeaſed and compoſed, that God, *vvho leads the hearts of all Kings in his hand, as the Water of brooks*, will ſo direct his Majeſties heart for your right, that his Majeſty will aſſiſt your Highneſſe, and turne his powerfull Armes another way, and make your Highneſſe Generall of a brave Brittish Armie, for the vindicating of your injuries, and the recovery of your lawfull and antient rights and inheritances, againſt the uſurpers thereof.

I will not trouble your Highneſſe any longer with a tedious diſcourſe, ſeeing my ſelfe, and thouſands of true hearted Brittaines beſides my ſelf, (whenſoever his ſacred Majeſty and our dread Soveraign ſhall lay his commands upon us) ſhall be all willing to fight in ſo juſt a quarrell, for your Highneſſe, and lay our lives down at your feet, and your Queen mothers, for the regaining of your Highneſſes Rights and Countries.

This third part then of the *Principles of the Art Military*, comes in all humility to preſent it ſelfe unto your Highneſſes gracious patronage, that though it be mean in it ſelf, yet it craves to come forth to the view of the world, under your illuſtrious name, which if it may be acceptable unto your Highneſſe, then I ſhall think my weak indevours happily ſacrificed, and acknowledge my ſelfe much obliged to your Highneſſe, and ſhall not onely be bound to pray unto the Lord of Hoaſts, to honour and bleſſe your proceedings here in this world with happy ſucceſſe, but alſo to crown you, your *Royall Mother the Queen of Vertues*, and her princely progenie with eternall felicity hereafter, beſeeching your Highneſſe to beleeve, that no creature living ſhall more heartily fight, nor more willingly die in your ſervice, then

Sir,

Your Highneſſes ever moſt humble, Obedient, and devoted Servant,

HENRY HEXHAM.

BRIEFE TREATISE

of eight ſeuerall peeces of Ordnance, as they are founded vnder the Commaund of the Lords the States Generall of the Vnited Provinces,

with their appurtenances, carriages, Engines, together with Morters and Petards, quadrants, and Inſtruction for Maſter Gunners, and Canoniers with diverſe other Inſtruments & materials, belonging to the warres, with their ſeverall vſes, and practizes demonſtrated.

THE FIRST CHAPTER.

Treating of the Leagues, Alligations, and Commixture of mettals, wherewith Ordnance are Caſt, and made in theſe Countries, and elſe where.

THe *Alloye* wherewith our Ordnance is made here in theſe Countries, is commonly old caſt *braſſe peeces*, ill proportioned, burſt, or made vnſeruiceable with too much Shooting, and therefore, muſt be refounded into ſome better, and more ſeruiceable *formes*, or are ſuch perhaps, as are too great for ordinarie Carriages and bullets. If theſe old braſſe peeces be of too fine a *mettall* (wich yet is ſeldome found) the Mr. *Founder* maye mingle ſome ſlighter copper amongſt it; yea ſo much as he in his iudgment ſhall think fitting: ſo that the Ordnance, which he makes be anſwerable to their proofe.

Our newe Ordnance then being founded with theſe new *alligations*, and *alloyes* are commixted with three fourth parts of red Copper, made vp in Sowes one fourth part of Bell mettal caſt alſo in Sowes, and one ninth part of the fineſt Cornish tinne you can gett.

Theſe bricks are peeces of red copper weighing, about 50 lb. weight, caſt after the faſhion of a square footed pauement, and your great Sowes, are peeces of other Copper, melted one timeleſſe, then your brick Copper, where of ſome of them weighes 200, 300. yea the greateſt 600 lb. a peece, The is tinne mix ed amongſt the Copper, and Bell-mettal, that they maye run ne the better in melting, which makes your peece more ſolid and firme.

*But in Italy S.*nor. Alexander Bianco (*as maſter* Norton *oneof his matias, maſter Gunoners, and Enginier citeth in his practize of Artilerie*) *ſaith, That the beſt* Alligations *of theſe mettals for Ordnance is for every 200. lb. of Copper 20 lb. of tinne, and 5 lb. of braſſe, or Latton is to be mixted therewith. And* Digeo Vffano *a Spainyard, Captaine of the Ordnance in the Caſtle of* Antwerpe, *in his inſtruction of Artilerie affirmeth, that the beſt* ligature *for Ordnance is 100 lb. of Copper, 8 lb. of tinne and 5 lb. of Latton, and 10 lb. of Sow-lead, affirming that lead being tough & cold, maketh the peece become hard. But le* Sieur de Briſſac, *a french man in his* militatie diſcourſes *ſaith, that the french, Founders vnto every 100 lb. of Copper doe either ad 20 lb. of Bell-mettal, which is 25 pound of Tinne & Lead for 100 lb. of Copper, or braſſe, or elſe 10 lb. of ſoft tinne to every 100 lb. of Copper.*

The Lords the States have in the Hagh a very brave founderie, and a work-houſe ioyning to it, in which they doe all their maſſive *workes, and behinde that a ſpacious roome, where they Set and place all their carriages, which is kept faire and dry, and beſides the* Maſter Founder *hath a houſe to dwell in, all which belongs to the Land.*

The Maſter Founder *muſt be very carefull in makeing choiſe of his powders, & Earths wherewith he is to make his* Mouldes *for the Caſting of braſſe Ordnance in, that they be able to reſiſt the fire, and receiue the melted mettals: So that they maye render them to be eaſt, and founded neately, without being Subject, either to be diminiſhed, crackt, or peeld, when they ſhalbe nealed, which is ſuch a matter, as without experience cannot be done well. Wherefore, I wil conclude with maſter* Norton *in his practize of* Artillerie, *that good Earths are neither fatt, nor leane, but betweene both, and of a fine and ſubtill graine or mould, which ſoone dryeth, and remayneth firme, without breaking, being able to reſiſt the* vehemencie *of the fire, and ſuch Earths are moſt commonly of a yellow, or a red colour.*

Now to finde such Earths, as are fitt for your worke, it behoueth you to sinke diverse pits, or Caues *vnder ground, which have not bin much stirred. And after you have begun your worke, and Compounded your* Earths *in a bouke, or heape, and wett, and moistned them like* paste, *begin then to heate them with a rod of yron, as the Potten vse to doe their Claye. Then take two third parts of the whole* lumpe, *and mixe it with* lint *of linnen cloath, and then beate the same together, vntill they be well* incorporated, *that they maye appeare all one* substance, *and if any small stones should chance to fall amongst it, then pick thene out, or bruise them, as small as maye be, that the powders being well tempred, maye serue for your moulds and formes.*

Of makeing of moulds for the founding of Ordnance.

THe Master Founder having prepared, and resolued of what kind, and what sorte of that kinde the Ordnances is, which he intends to cast, he is then first to make a perfect Modell there of, either of timber, or of Earth, orboth, with all the Mouldures, Ornaments, & compartiments, euen as you would have the peece to be, which you must thinnely annoint with soft hogt-grease, and then cover it over with a Colume of the afore said tempered Earthp, made and dryed by little and litle, augmenting it, vntill it be of a Competent strength, and thicknesse. This Colume must be made so, as it may be taken into two or more parts, to the end, to take the said modell, or patterne out of yt, and it is to beefortifyed on the outside, with plates of yron, at long as the Chase of the peece is, and with yron Wyres an inch each from an other, and lastly with y-ron Hoopes a foote, or two assunder, to knock off, and on, as occasion shall require. Their must also be a smooth, and equall Cillender, whose Dyamitre must be iust the beigth of the Bore, and made of the same Earth, moulded vpon a stronge Iron square Barre, and vpon a Cord woulded about the same, to make therewith the soule, Concaue or hollow Cillinder of the peece, by placing yt (by helpe of the Base, and Muzzle ring) exactly in the midst of the Vacuity of the outermost Colume, which whenthe Patterne, or Modell Shalbe taken out, will remaine hollow, to receiue the metrall, that must make the bodie of the peece. All these must be well ioynted together, polished smooth, dryed Nealed, that the mettall maye runne fine, and come off smooth and neate.

Lastly, the patterne of the breech, with all the Mouldures, and Cascabell, is in like manner to be Couvered ouer, by litle and litle with the same tempered Earth, which must afterwards be Luted neatly, and strongly to the breech end of the outter Colume: all which Mouldures, Rings, Armes, Devises, Flowers, Trunions, Dolphins, and Circles, maye be at pleasure added there vnto, vpon the patterne, either with waxe, earth, or plaister, and so the perfect Impression thereof wilbe receiued by the Concavity of the out ward Colume, keeping still the due prescribed proportion of the peeces (yow intend to cast) accordingto the kind & sort thereof, for the rest se master Norton in his 21, & 22 Chapters of the practize of Artillerie.

Having thus digressed, I will returne againe to my former matter, and giue the gentle Reader to vnderstand, that the States have Conditioned with their Master Founder, that he shalbe at the charge of makeing all Mouldures, Formes, castings, borings, and finding of firing, for which he hath from the States six gildens, or 12 hillings starling, for the founding, of 100 lb. weight; so that for a whole Canon, which weighs 7000 lb. weight, he hath 840 gilders for him and his men, the rest proportionally. Now when any old brasse peeces are to be cast, they are deliuered to him by weight, and he is allowed him ten pounds in every 100 lb. weight for drosse and wast: for you must vnderstand, that Copper & brasse have much more drosse in them, then gould or silver, because the finer the Alloye is, the lesser it will consume by fire.

The greatest number of new peeces cast in the States Founderie at the Hagh, euery yeare by the helpe of some, 20 men are sixe whole Canons, twelve half Canons, and sixe long Feild peeces, or demy Culvering, makeing in all the number of 24 peeces of Ordnance. But of late yeares they cast diverse sorts of french short Demy Canon, and smaller Drakes, as now the occasion of service requires.

These Ordnance being founded and made, the Master Feunder is to deliuer them to the States vpon Proofe in the presence of some Commissioners, and the Controuleur of the Ordnance, who are to ouersee them, and to take care, that the peece, which is to be tryed, be well loaded with her due weight of powder, and bullet, and rammed well home.

The proofe of a whole Canon which weights 7000 lb. weight, and carries an yron bullet of 48 lb. weight must becharged with 32 lb. of fine powder, and with the bullet aboue said well rammed home; but the ordinary charge then of it wilbe noe more then 20, 19, or 18 lb. of fine pouder at the least: A halfe Canon which weighs 4500 lb. weight and shootes a bullet of 24 lb. weight, the proofe Shott must be 16 pounds of fine powder & the ordinarie charge 12 lb.

A Feild peece, which weighs 3200 pound weight, carrying a bullet, of 12 lb. must be loaded with nine pounds of fine powder, but the ordinarie charge is noe more but sixe pounds.

The Faulconet, that weighs 2100 lb. which carries a bullet of sixe pound weight, must be loaded with 4 and a halfe lb. of fine powder for it proofs shott, and with 3 lb. for its ordinarie charge.

Note also, that a Canon, which shoots a bullet of 48 lb. must be bored for a bullet of 52 lb.

Weight, A Demy Canon, which carries a bullet of 24 lb. must be bored for a bullet of 28 pound.

Weight, A quarter Canon, which carries a bullet of 12 lb. must le bored for a bullet of 16 lib.

A Faulconet which carries a bullet of 6 lb. weight, must be bored for a bullet of 8 lb.

Your whole Canon, and Demy Canon, are commonly peeces for Batterie, vsed at seiges for to make a breach, but your Feild peeces, and Drakes are to be drawne to some suddaine peece of seruice, as in the day of Battle, vpon a Passage, or vppon Plate Formes, & Batteries made vpon the line of Circumvalatione, or for the defence of a Campe, when an ennemy is at hand, and the rest of the short chambred Drakes likewise.

A Canon or a smaller peece of Ordnance, maye shoote in 12 howres some 80 shoot, yea 100, if it be not Ouer Heated, but after yow have made with it some 10 or 12 shott at the most, it must have a Cooling time, by casting ouer the breech of it a Danck hair cloath a pretie while, and that will coole it enough.

For

For a whole Canon mounted vpon a block waggon, or vpon its owne Carriage, it is commonly drawne in theſe hollow, and marshie Countries, with a teeme of 15 couple of Buſkie horſes, beſides the Thiller horſe, making account, that euery couple of horſes, muſt drawe for their shares 600, yea 650 pound weight if they be well putt to it. A Demy Canon with eleuen couple and a Thiller horſe, a quarter Canon with eight coupple and a Thiller horſe, & a Faulconet with foure couple & a Thiller horſe, and your ſmaller Drakes with a number proportionable to the weight aboueſaid, yea euen to a ſmall Drake carrying a bullet but of one pound weight, is drawne but witha Thiller horſe. The length of the chaſe of euery peece both Reinforced & Chambred is noted aboue its figure.

The Demonſtration of the eight peeces of Ordnance, which are in moſt vſe, vnder the Lords the States ſervice.

And firſt of foure peeces of Ordnance reinforced Plate A.

NVm. 1. is a Faulconet weighing in mettal 2100 lb. weight, being 10 and three quart of a foot long, which shootes an yron bullet of 6 lb. weight, which being layd leuell by the mettall, otherwiſe called the Horiozontall levell 800, by the Levelaxis, or diſpart, commonly called point blanck 400, & at the bigheſt range 4090 paces at 2 and a halfe foote to the pace.

Number 2 is a Feild peece, or a quarter Canon, weighing 3200 lb. being 8 foote and three quart of a foote long, wch shootes an iron bullet of 12 lb. weight, & carries by the mettall 600, by the Axis or point blanck 300, and at the higheſt range 3800 paces.

Number 3, is a Demy Canon, weighing 4500 pound weight being 10 and a halfe foote longe, carrying an yron bullet of 24 lb. weight, which will shoote levell by the metall, or Horiozontall levell 800, by the Axis or point blanck 400, and at the higheſt range 6000 paces.

Number 4, is a whole Canon, weighing in mettall 7000 lb. weight, carrying a bullet of 48 lb. weight, which shoots by the mettall, or Horiozontall levell 1000, by the Axis, or point blanck 500, and at the higheſt range 7000 paces at two foote and a halfe to the pace.

I referre the Reader to the other ranges ſpecifyed in the Quadrant and table fallowing.

Of the other foure peeces of Ordnance, called Drakes chambred Plate B.

NVmber 5. is a ſmall Drake, weighing 280 lb. weight in mettall, and is 4 foote long, carrying a bullet of 3 lb. weight, charged with one lb. of powder, which will shoote levell by the mettall 176, by the Axis, or point blanck 40 and at the higheſt range 800 pace.

Number 6. is a Drake weighing 580 pounds, is 5 foot long corring a bullett of 6 lb. weight loaded with 2 lb. of powder, which will shoote levell by the mettall 196, by the Axis or point blanck, 100, and at the higheſt range 2500 paces.

Number 7. is a quarter Canon Drake weighing 1130 lb. weight in mettall, is 6 foote long carrying a bullet of 12 lb. weight, charged with 4 lb. of powder, which will shoote levell by the mettall 264, by the Axis, or point blanck 140 and at the higheſt range 2500 paces.

Number 8. is a short Demy Canon Drake, weighing 2250 lb. weight in mettall, is 7 foote long, carrying a bullet of 24 lb. weight, with 6 lb. of powder which, will shoote by the mettall, or Horiozontall levell 340, by the Axis, despart, or point blanck 180 and at the beſt, or higheſt elevation 2770 paces. Note by the waye, that the longer the chaſe of a peece is, being reinforced *& well charged, the further it will carrie its bullet, and the ſtroak the more violent, as you maye ſee by long* Culverings, *and* ſlinghs *of ſome 24 or 25 foote long in chaſe, whereof the experience hath bin tryed at* Arnham *in* Gelderland, *where a long* Sling *lay vpon a Bulwarke, which shott from* Arnham *to* Nemegen *being 6 English miles diſtant one from an other. Againe, the Shorter the chaſe of a peeces is, as in theſe* Drakes, *the shorter it carries the bullet, as you maye ſee by their ſeuerall ranges.*

Yet this doth not alwaies hold true for Count Maurice Prince of Orange *of bleſſed memorie, tryed ance a half Canon vpon the* Strand *at* Scheveling, *giving it the due charge of powder, and cauſed the Canonier to levell in vpon its higheſt range, at 6000 paces, to trye this concluſion, to ſee how farre it would carry, when it was shorter, cauſſed ſome two foote and a half of yt to beſawne off, made it be loaded againe, shoot it off, and found that it carried it bullet as farre as it had done before.*

To conclude, with Touch-holes, I have ſeene in Oſtend vpon the Weſt Bulwark, that ſome touch holes of Canon, were blowne ſo great with often and continuall shooring, that I have putt my fiſt into them. Now ſuch a touch hole being blowne ſome three or foure incles, maye eaſely be remedied. For if yow bore the

hole round, and driue in a ſcrew of yron into it, as thick as your finger, and in the midſt of the ſcrew aboue ſaid, bore a ſmall Touch hole in yt, yow ſhall finde this to laſt longer vnblowne, then any other way, which hath bin invented, for now when Ordnance are caſt a new at this day, for the preventing of this two much blowing, they yſe now to make ſuch a touch hole with a ſcrew, as is here mentioned which will not ſo ſoone be blowne great, and as your braſſe or Copper Touch holes will.

THE SECOND CHAPTER.

Treating of a ladle, a Rammer, of a Sponge, and a Feild Carriage for a peece of Ordnance as ſhall be demonſtrated vnder the Carriage.

THe figures of a ladle, a Rammer, and a Sponge is repreſented vnto yow vnder the Fanlconet, and feild peece, with their iuſt lenght, and thickneſſe, after which forme yow maye make all others for what ſorts of peeces yow pleaſe, and with all obſerue, that the bigneſſe of them muſt be according to the Dyamitre of the bullet which your peece carries. The lengh of the ladle vnder the feild peece with the ſtaff and Rammer is 11 foote, and 9 inches & a halfe long. The opening of the ladle is a foote and a fourth part of an inch. The braſſe plate rounded to the ſtaff, and to the height of the ſhoot, and due vent allowed is fiue inches. The ſtaff of rhe ladle 3 ynches thick made of ſoft faſt wood as Aſpe Beech or willow. The Rammer B is 4 inches, turned with hard wood, and the length of the copper ladle a foote and ten ynches, the ſtaff to the neck on both ſides is 3 inches thick. The Dyamiter of the bullet is traced out with pricks coming downe from the ladle marked 1, 2, & 3.

The Spunge C. is couvered with rough sheeps skinns wool, and nailed to the ſtaff with Copper nailles ſo that it maye fill vp the Soule or Concavity of the peece when it is to be ſcowred and cleared. Note alſo thar the Copper ladle for a peece of ordnance muſt be threetimes the length of the Dyamitre of the bullet. Such a ladle coſts the States 6 gl. 10 ſtivers, vidz. The ſtaff 2 gl. and 14 ſtivers for a whole Canon, for a halfe Canon 5 gilders, for a feild peece foure gilders 10 ſtivers. And the Rammer, the ſtaff, and the Sponge of sheeps skinne will coſt two gilders 14 ſtivers.

Yow have alſo in the plate B figure, 9 repreſented vnto yow the figure of a Carriage for a feild peece with all the Dimenſions, ioynts, and parts belonging to yt.

The Naues, The cheeke, called limbres, and the wheeles are made of Elme, but the Tranſoms, The Axeltrees, the ſpoakes of Oaken timber, and the fore carriage of the wheeles are made of the ſame wood, as the former are, but the Tranſoms are elme and the croſſe beames of Oake as the ichnographie of the Carriage Figure 9 showes.

The Lords the States have agreed with theit Maſter Carpentes, to make them a Carriage for a whole Canon for 134 gilders 10 ſtivers, namely the two ſide peeces 15, or 16 foote long, 17 inches broad, and ſix and a half inches thick, for 59 gilders, and to every carriage foure tranſoms for 6 gilders. An Axeltree for 4. gilders 10 ſtivers, The two wheeles 37 gilders 16 ſtivers, for the framing and makeing of the carriage for a whole Canon 27 gilders 10 ſtivers, for an Axekree 1 gl. 10 ſtivers. for the makeing, of the wheeles 10 gl. which comes to in all, as aboue ſaid to 134 gilders 10 ſtivers, and ſo the reſt of all Carriages proportionally.

The Demonſtration, or Terciating of the whole Canon, Num. 4. and alſo of the Demy-Canon Drake chambred, Num. 8.

with their ſeuerall names and parts diſcribed.

Note firſt that a peece of Ordnance is diuided into three parts. 1. *The* Breech, or chamber 2, the trunions, & 3 the Muzzle, *or neck, and the length of the whole peece is called the* Chaſe, *or* Colume.

A. is the Cornish, *brow, or* baſe ring *of the peece.*

B. is thee peeces neek. C. the peeces Boutill, *or* Aſtragall *called the muſſel* Ringe.

D. The Reinforced ring, *E The* tronion-ring, *& theſe 2 tronions are two* ſpyndles, *vpon which the peece lieth in its carriage. E H. is that part of the peece, betweene the Breech, the tronions, & the eares.*

F I. is the Calibre, *Mould, or the bore of the peece. G. is the* touch-hole, *and all the metall behinde the* touh-hole, *is called the* Breech. *F H. is the* Coile *of the peece. H. The* Caſacabel, *or the out moſt* pommel *or button of the peece. F L, is the* mettaline *Subſtance, & thickneſſe of the* Coile, *about the breech of the peece about the* concave Cillender, *otherwiſe, called the* Sowle *of the peece.*

M. is the mettaline Subſtance *at her eares, and Stayes of* Gravitie, *by which shee is hoiſed vp into her Carriage. So much of her bore, as contayneth the powder, and shoot, is called the* chamber, *or charge* cillender; *the reſt the vacant* cillender, *& all the rings circles, andeminences at her mouth & breech are called the* Friezes. *To conclude, the ordinarie Canons of Batterie is ſeuen eights of ſubſtance in their chambers fiue eights at their. Trunions, & three eights at the muzzle, or necks of the* Dyamitre *of their* Calibres, *or boores in thickneſſe of mettall. And thus much briefly for the demonſtrating of anyother peece of ordnance what ſoeuer.*

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THE DEMOMSTRATION OF THE NEXT Figures following, and firſt of a Block, or a long Waggon:

THE THIRD CHAPTER

THe firſt figure underneath number 10. sheweth you of what ſingular uſe and accommodation your *Block*, or *Lisng waggon* o for the carriage, and drawing of a peece of Ordnance, or for the carrying of ſmall Punts, or Boats to clapp on a ſunden over a River, or a brooke, when occaſion may ſerue: therefore there is no one Inſtrument more uſefull for the traine of Ordnance then this is, and are excellent good alſo to ſtop an *Avenue* or a paſſage croſwiſe, where an Enemies horſe may breake in upon an Armie unawares, eſpecially, when one hath no time to caſt vp a trench, or a traverſe vpon it. Beſides, a peece of Canon will be eaſilyer drawne, through moorish, foule, and ſandie wayes vpon this, becauſe the peece lieth more ſteddie, and is not ſubject to ſo much wrenching aſide in durtie and Ruttie waies, then vpon its proper Carriage. Now whenſoever an Enemie should draw neere unto an Armie by the helpe of the *Fearne*, you may quickly hoize it vp, and laye it vpon its own carriage. The forme and moddle whereof is repreſented unto you in the figure following, noted number 10.

The ſecond figure number 11. demonſtrates to your eye a halfe Canon mounted vpon its carriage, drawne with ſeven couple of horſe, and a *Thiller* horſe, and this to be underſtood in a good way: but if the way be foule, morish, and durty, then for a whole Canon, weighing 7000. li. weight, you muſt ſpanne in 15. couple of horſe and a *Thiller*; for a *halfe cannon* eleuen couple and a *thiller*; for a feild peece or a quarter Canon ſix couple and a *Thiller*; for a *Falconet* two couple and a *thiller*; and for a ſmall *Drake* weighing 250. pound weight. one horſe. You muſt obſerue alſo that the mettle of one of the States half canons weigheth (as is ſaid before) 4500 pound weight, the carriage and yron worke thereunto belonging about 900. pound, ſo that theſe horſes are to draw in all the weight of 5400. pound, and the other peeces proportionably.

The third figure, number 12. repreſents unto you this, that when you want or cannot uſe Canon horſes and *Athrals*, how you may then by the helpe and ſtrength of men, drawe a peece of *Ordnance* to the topp of a hill, and there to make a *Platforme* for the battering of a Caſtle: Now preſuppoſe you are to batter it with 16. Peeces of Ordnance; to wit, eight *Demy canon*, and 8 *Quarter canon*, the firſt carrying a bullet of 24. li. and the ſecond of 12. li. and are to carry along with you all neceſſaries, as Powder, Bullets, Match, bedding, traces and diverſe other materials. The queſtion is how many Souldiers, Pyonniers, and workemen are able to doe this? which *Diego Vffano* in his 22. Dialogue reſolveth in this manner following.

Of a Block waggon, and drawing of Ordnance.

Firſt for 600. halfe Canon Bullets, each bullet weighing 24. pound, the whole weight of them will come to 144000. pound. Now if you lay three of theſe bullets, in a wheele-barrow, they will make 72. pound for every Souldier to wheele, and will require 200. men to doe it.

And for 600. quarter canon bullets, weighing 12. pound a peece, the weight of the whole will be 7200. li: now putting 7. of theſe into a wheele-barrow, for every mans share to driue, you muſt haue 86. men in all, and every man as before 72. pound weight.

Item for 168. weight of powder, for to charge theſe 16. peeces of Ordnance withall, each halfe canon requiring 12 pound of good powder for its charge, and for your quarter canon, or field peece 7. pound; you muſt have 240. ſmall firkins, or ſo many leather powder baggs to carry it in, and giving to euery Souldier 70. pound weight of powder, it will require the like number of 240. men to carry it, as is repreſented vnto you in the fourth plate and 12. figure following.

Now for the *Attelage* or drawing ropes for theſe 16 peeces of ordnance, repreſented vnto you

alſo in this fourth plate and 13. figure, is shown you the manner of it, by dividing your men into three drawing files or teames, according to the greatneſſe of the peece which your men are to draw up, for a Demy-canon, carriage, attelage, and all will weigh a matter of 6000. pound weight, now giving to every man 60. pound weight to draw ſuch a halfe Canon will require a 100. men to draw it, and proportionably the 8. half canons 800. men.

For a quarter Canon, carriage, attelage and all, will weigh 3000. pound weight, now allowing to every 60. pound weight to draw, every of theſe 8. peeces will require 43. men, ſo that for theſe 8. quarter Canons you muſt have in all 344. men, which being (as is ſaid) divided into three equall files and diſtances, each drawing rope muſt have 14. men and one odde man over to go by.

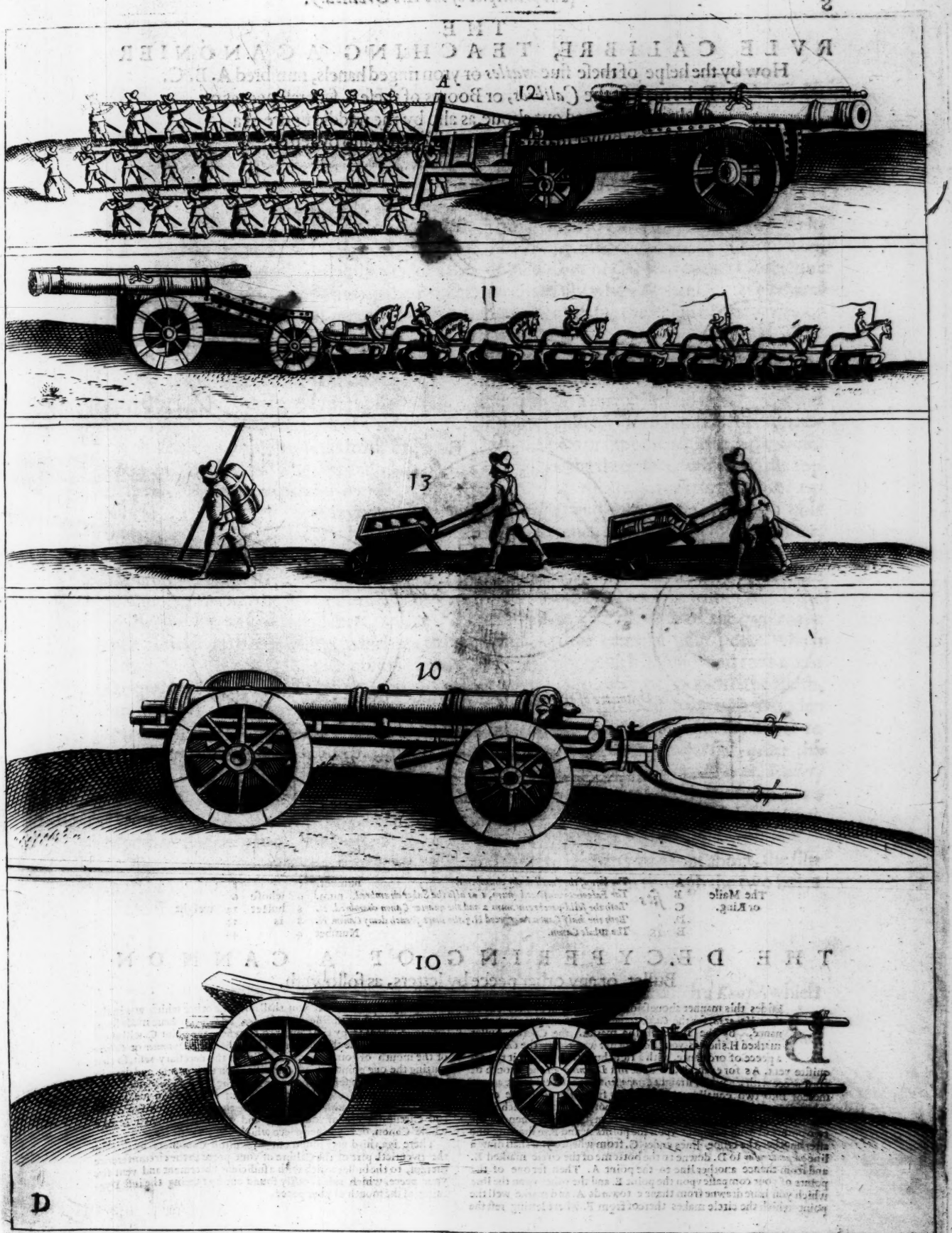
And becauſe it may ſometimes happen, that by reaſon of the ſteepineſſe, badneſſe, and unevenneſſe of the way, you may be driven to diſmount and remount your peece ere you get up to the top of the hill, you muſt carry along with you a *Fearne*, a *winch*, or a *Scalet*, with all appurtenances thereunto belonging, as winding roaps, an iron goats foot, with a crow, pinns, truckles, pullies to help you withall at a dead lift. All theſe Engines and Materials may conveniently be carryed on the ſhoulders of 30. men, inſomuch that if you make your calculation you ſhall find that you muſt have for the drawing of theſe 16. peeces of Ordnance, and for all things above ſpecified, the number of a 1703. men without any difficulty will do the deed and draw theſe Ordnance whitherſoever you pleaſe. The Fearn the figure and its neceſſaries ſhall be deſcribed unto you in the next chapter following.

Now for your attirals or drawing harneſſe, to the end that every man may draw alike ſhare you muſt faſten a croſſebeame or barre to the end of the fore waggon marked as you ſee with *A. B.* through which you put your drawing roaps into an equall diſtance, that your men may not hinder one another drawing, having behind it three men to ſteer the peece aright, when you come to any winding or turning in the way.

Again, if it be a whole canon or a peece of Ordnance, which you are to draw through a trench to a battery, or ſome other place, where you would plant it, and find theſe drawing ropes to ſhort for the men that are to draw it, then you muſt lengthen the ropes and faſten another croſſe barre juſt in the very midſt, and this will guide your peece from wrenching aſide for certain, the ſhorter your drawing ropes be, the more ſteddier and eaſier your peece willbe drawn, to every drawing rope alſo you muſt have as many necklines to caſt about your mens ſhoulders as you have men, to the end they may draw with more eaſe, ſtrength, and take firmer footing. Nevertheleſſe if you draw your peece after this manner up to ſome ſteepy hill leaſt the peece ſhould fall downward and overturn them, for the avoiding of this danger, they muſt in an inſtant whip theſe lines over their heads to looſen themſelves from them, or elſe cut them on a ſuddain, but then it is ſafer to draw with their hands.

This manner of drawing of Ordnance is no new thing, but hath been practiſed by the firſt conquerours of the *Weſt Indies*, as *Pizarre*, *Ferdinand Cortes*, and diverſe others, who with the ſtrength of men drew their Ordnance over hils and mountains to the City of *Mexico*. Likewiſe *Henry* 4. King of France, of immortall memory, uſed this manner of drawing of his Ordnance over the Alphes in his laſt warres of *Burgundie*, and inſtead of pyoniers uſed luſty Swiſſers to do it

The 5. rings called in dutch, Mailles, number 14. is to try whether the bullets which you are to chooſe in the Arſenall will fall through them, which if they do, then they will fit your peece to a hair, the ſeverall bores and calibres of your 8. peece of Ordnance deſcribed before.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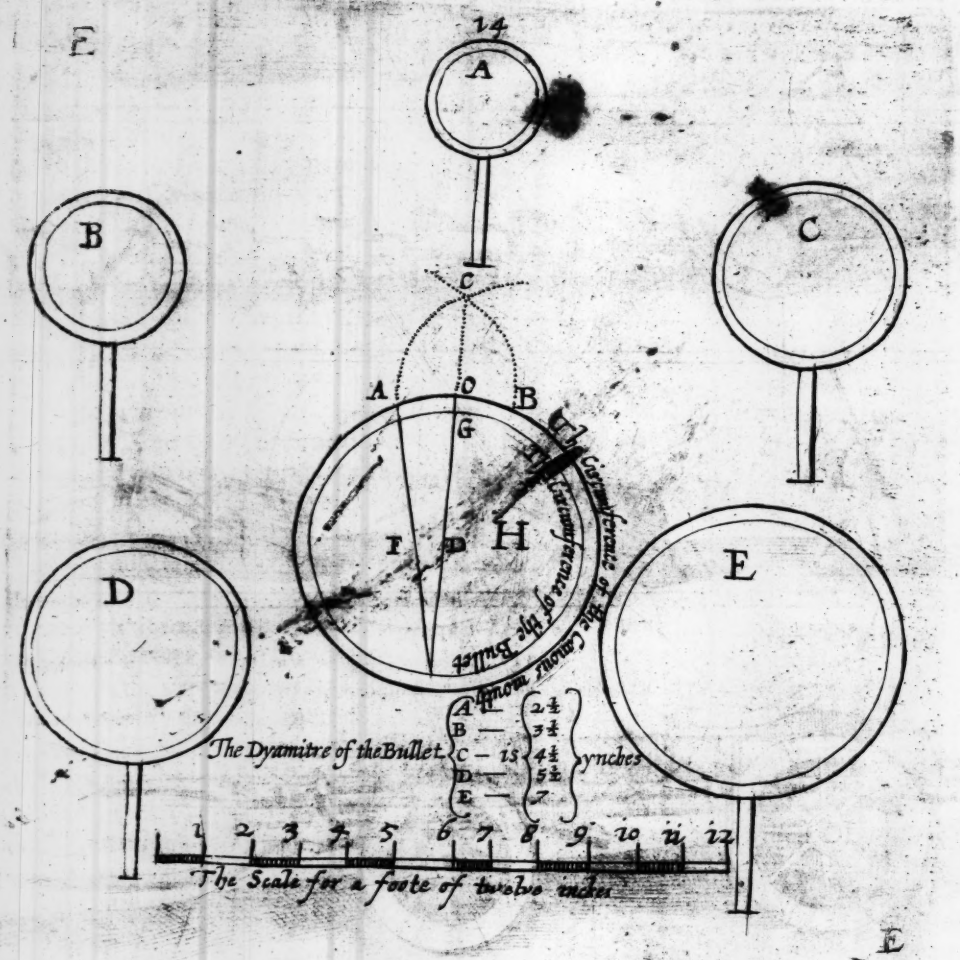
THE RVLE CALIBRE, TEACHING A CANONIER

How by the helpe of these fiue *mailes* or yron ringed hanels, numbred A. B. C. D. E. he may fit the *Calibres*, or Boores of these 8. seuerall peeces of Ordnance, figured out aboue, as also by the middle figure of a Canon bullet marked H. and decifered also by letter.



	A		*The bore of the small drake chambered*	number.	5		3	
The Maile or Ring.	B	*fits*	*The Falconet reinforced num, 1 as also the Saker ch ambred.*	num.	6	whose	6	
	C		*Both the feild-peece reint.num 2 and the quarter Canon chambred. N.*		8	bullet	12	weight
	D		*Both the half Canon reinforced N.3 .the short french demy Canon. N.*		8	is	24	
	E	is	*The whole Canon.*	Number	4		48	

THE DECYFERING OF A CANNON Bullet, or any other peece by letters, as followeth.

BEsides this manner aboue said, by fitting your bullets out of the *Magazin*, for the *Calibres* and bores of any peece of ordnance, by the helpe of the mailes, the Caeron bullet marked H. shewes you also another way to fitt the *Calibre* of a peece of ordnance, with a right bullet, by giuing it the requisite vent. As for example, take the iust *Diamiter* of the mouth of your peece with a paire of straight *Compasses*, and then devide the *ouertur* thereof into two equall parts, and draw from the *Center* the circle marked B. A. and E. whose *Center* also is noted to be *D.* which is the forme and *Circumference* of your peeces mouth or bore, Then set the two points of your compasse vpon the points A. and B. in drawing one after another, the crosse-lines vnder C. from whence you shall draw a line *perpendicular* to D. downe to the bottome of the circle marked E. and from thence another line to the point A. Then set one of the points of your compasse vpon the point E. and the other vpon the line which you haue drawne from thence towards A. and marke well the point which the circle makes thereof from F. where letting rest the point of your Compasse, you shall raise the other which was in the point E. vpon the first line *perpendicular*, which you haue made from the crosse-line at C. by the Center to D. where the point C. will shew you how much lesse the bullet must be. Then the *Dyamiter* or *Calibre* of the mouth of your peece, for giuing it the necessary vent, so that putting the one point of your compasse upon the *center* D. and draw in the other which is sett vpon the edge of the *circumference* and Largenesse of the peeces mouth O. to the point G. and so in making an other circle the Dyamiter thereof will be the iust and requisite *calibre* and Circumference of your bullet, and which will fit the bore of a whole Canon, or any other peece which you shall desire.

There is a third way found out by skillfull Canoniers, by abating the twentieth part of the Calibre of your peece in the circumference thereof, to the bullet which with a sufficient abatement and vent for your peece, which rule is easily found out by takeing the iust Dyamiter of the mouth of your peece.

OF A FEARNE, A SCALET, AND A WINCH.

The description of a Fearne, *called in French a* Guindall, *in Netherdutch a* Bock, *from a Goate, with a* Scallet *and a* Winch, *being of excellent use about the traine of Ordnance, Represented unto you in the fift plate, and 14. 15. and 16. figures following.*

THE Carriage being placed in a readineſſe, you are then to hoiſe up your peece into it, which in regard of the weight of it, be it a Canon or any other great peece of Ordnance, cannot be well done without the ingenious help of the *Fearne* or *Ghynne*, ropes, a Goats foot or an yron crow, leavers to wind up the Rouler, &c. eſpecially when a wheel is graveled, and ſticks faſt in ſome deepe rutt, or rotten ground, then you muſt uſe the helpe of the *Scallet* or *Winch*, demonſtrated unto you in the figures following.

Firſt then you muſt make and frame your *Fearn*, according to this model uſed in the States ſervice, which is accounted the beſt, number 14. and for the goodneſſe of it ought to be preferred before all others, and for the lightneſſe of it may upon a march be laid upon a waggon to be carried along in the train of the Ordnance with the Scallet, Winch, and all appurtenances thereunto belonging. It is made upon three feet, beames or ſupporters, triangular-wiſe, upon which it ſtands. The demonſtration is this *a. a. a.* are the three feet, which at the top or head of it are induſtriouſly joyned together, from *b.* to *c.* is the length of it ſome 13. or 14. foot long: it is framed a foot broad, and half a foot thick, *d.* and *e.* showes a great iron bolt with a round head, and at the other end a croſſe wedge to clench and joyne it cloſe together, *f. g.* is the copper hook and ring, upon which the uppermoſt pullie or Truckle hangeth, *h.* the uppermoſt truckle it ſelf, through which the ropes are let down and wound up, *i. i.* the cable or winding roap, *k.* the lower truckle above the Rouler, *l. l.* the plate-work within which the rowler turns in its bed and ſockets, *m.* is the rowler it ſelf, *n. n* are the ends of the two roaps well pleated and bound about, which are to be put through the eares of your peece which is to be hoiſed up, *o. o.* the two oblique yron plated feet, upon which it ſtands and reſts upon the ground, and by reaſon they are ſo made, cannot ſo eaſily ſlip away, or ſinck into the Earth, but makes the Fearn to ſtand ſtedfaſt and firm, *p. p.* are the holes into which the two wooden leavers are put into the Rowler and wound up by two men, the one taking out his leaver to put it into an other hole, while the other with all his ſtrength holds the rouler faſt, *q.* are the two winding leavers, *r.* the Goats foot or yron crow, neceſſary both for the *Fearne*, *Scallet*, and *Winch*. One of the winding roaps muſt be at leaſt 25. foot long, and in circumference a Geometricall inch, and one fift part, the ends whereof muſt be ſo wreathed and bound faſt together, that they muſt not looſen.

The main roap muſt be 73. foot long, and 1. and three foure parts of a foot about, the ſlip muſt be well wrought and bound about with packthred, which is put through the two holes of the Rowler.

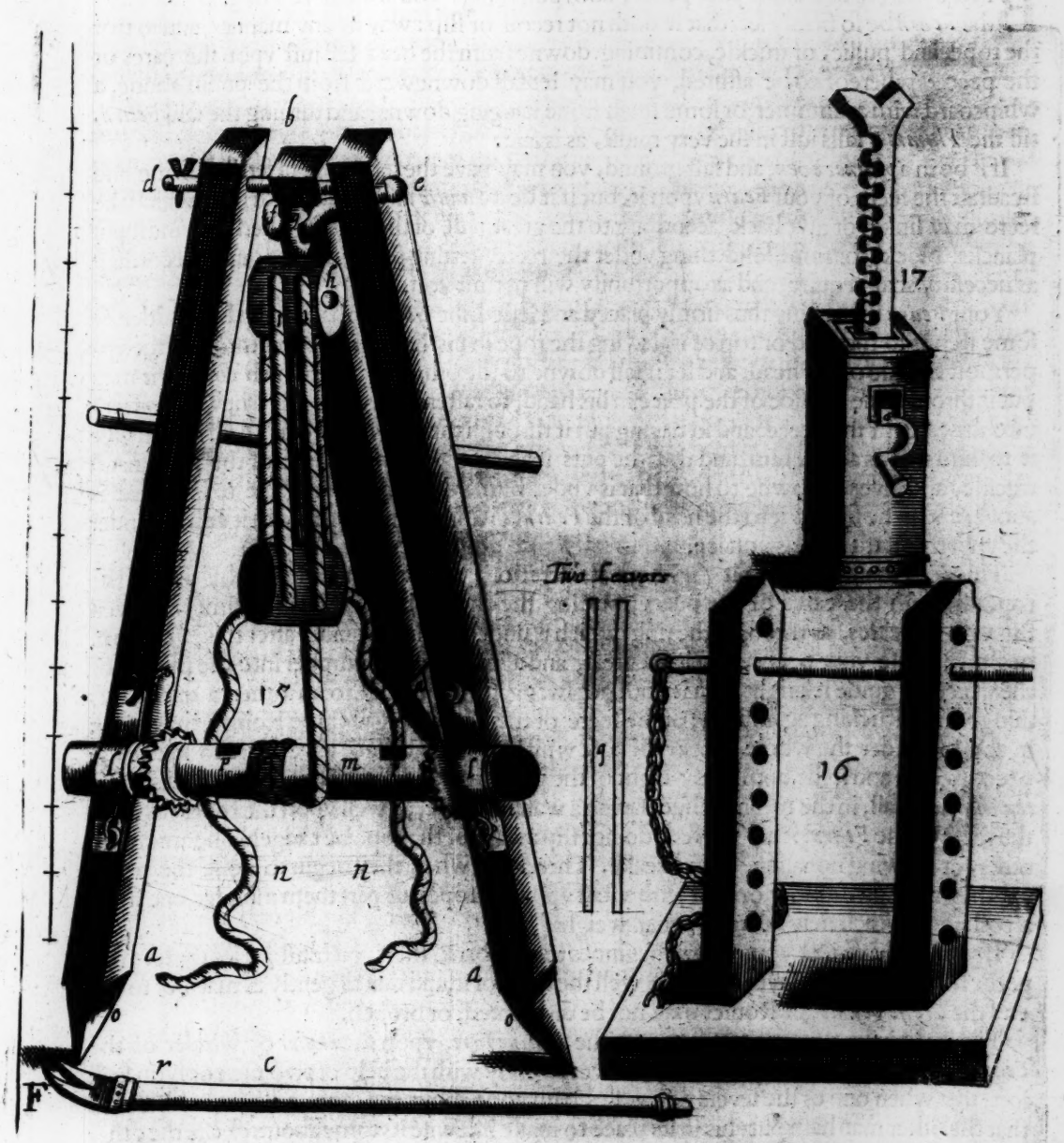
OF A SCALLET.

The other Engine is called in French a *Scalet* or a *Ladderet*, in Netherdutch a *Knape*, which muſt have likewiſe a ſtrong iron crow belonging to it, a thicke oaken board upon which the pillars or ſupporters of the weight ſtands, which are well nigh two foot long and a foot broad and about halfe a foot in thickneſſe.

The two pillars of the *Scalet* muſt be enchaſed a quarter of a foot in the thick board, to give it the more firmneſſe whereupon they ſtand, and muſt be a matter of 2. Geometricall foote high about the ſaid board, and $\frac{1}{3}$ and $\frac{1}{4}$ part of a foot thick each pillar as you ſee having 8. holes boored through them at an equall diſtance one from another, through which you are to put

your great yron bolt, which with the iron crow muſt ſuſtain and beare up the ponderoſity: unto this bolt there is an iron chain faſtned to it, and nailed to the right hand pillar as you may mark: the bolt it ſelf ought to be one and one fifth part of a Geometricall inch round, and one an a half of a foot long, each pillar muſt ſtand at leaſt half a foot one from an other. Vpon this yron bolt, which may be put into any of the holes as you raiſe vp the peece, and as occaſion ſerues, reſteth your yron crow and leavers, and receiveth ſtrength from it to lift vp your wheel peece, and all at a dead lift out of any rutt, moorish ground, or place when it ſticks faſt in it, and as you raiſe it, by this engine, you may clap thick fagots, or boards vnder the wheele, till you advance it higher to an other hole.

The *Winch* or *Windlace* repreſented here unto you in the 14. figure, is called in Netherdutch a *Windaes*, or a *Dumcracht*; and is a differing Engine from the former, but of ſingular uſe alſo for the heaving vp of a peece of Ordnance, carriage, and all, let it be never ſo great, or any ponderous weight, as blocks loggs &c. yea it is of ſuch great ſtrength and force that it is able to overturne a houſe, and hath no neede but of one man to put it a worke. Now to make it ſtronge and ſufficient, it muſt be two foote long at the leaſt, 1 foot and a half broad, and half a foot thick, with a vice, and a teethed ſcrue comming out of the midſt of the woodworke of it, and winding up its teeth by the force of two ſecret wheeles turning within the midſt of the woodworke. This Engine may alſo be uſed (as the former) for the lifting up of a peece of ordnance out of a deep rutt, morish ground, or any durt or mire into which it is ſunck; by laying of thick boards, and faggots vnder the wheele, as is ſaid; and this will be done quickly, ſo that you need not looſe much time vpon a march: and thus much in brief for the making and uſe of theſe three Inſtruments. The figures whereof follow in the next page.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HOW ONE IS TO MOVNT A PEECE VPON ITS carriage, by the helpe of a Fearne, or a Ghynne.

THE FIFTH CHAPTER.

BEfore you are to mount your peece, above all things you muſt have a ſingular care that the *Fearn* be ſo firmly ſet, that it doth not recoil or ſlip away in any manner, and ſo that the rope, and pullie, or truckle, comming downe from the head fall juſt vpon the eares of the peece: whereof to be aſſured, you may let fall downeward from the pullie aboue, a whipcoard with a plummet, or ſome ſmall ſtone hanging downe: and turning the ſaid *Fearn*, till the *Plummet* falls juſt in the very midſt, as is ſaid.

If it be in a *plaine, even*, and faſt ground, you may have the leſſe care in ſetting firme and ſteadfaſt the feete of your *Fearn* vpon it, but if it be a *Sandie* and a ſoft Earth into which the feete may ſinke, or give back, according to the greatneſſe of the weight, then you muſt put plancks, blocks, or ſome ſolid thing vnder the feete, ſetting tent pinnes about it, according as neceſſity ſhall require, and as opportunity will permit you.

Your *Fearn* then being thus firmly placed and ſetled, the *Gunner* ſhall get vp by a ladder, or ſome ſtepps to the head or top of it, having the rope in his hand, ſhall put it through the vppermoſt truckle of the head, and let it fall downe to the other, that he which catches it may put it through the left ſide of the peece in his hand, to faſten it, (as wee ſhall ſhew hereafter) into the eares of the peece, and ſo having put it through them, he drawes it vp till he can give it to him that is aboue him, and then he puts it againe through the hole of the right hand truckle, and gives it downe to him that is vnder him, who reaches it againe to him that is above: and ſo he faſtens it to the head of the *Fearn*, giving it ſome turnes, till it comes under the vppermoſt truckle, as you ſee.

This done, he muſt faſten it (with great diſcretion) to the lower truckle, by puting the rope through the eares of the peece, putting the end of it thorow three times, as well through the eares, as through the ring which is under the ſaid truckle: after this, you ſhall begin to hoiſe your peece, putting a great, and a long peece of timber into the mouth of the peece to guide it aright, that it doth not ſwagg from one ſide to an other; a dangerous thing, which ſtricking againſt one of the feete of the *Fearn* or againſt the Rouler, may break it, and ſo hinder the whole worke. Thoſe which mounts it, muſt have a care to keepe the peece ſteddie and right, untill the weight of the peece is well ſetled. The *Generall* or his *Lieutenant* Generall, in the meane while having a watchfull eye, as well vpon the ropes, as vpon the feete of the *Fearne*; that the feet do not ſlip away, or the rope be cadgeld one among an other, or drawing not alike, may breake. Therefore, when they begin to hoiſe the peece vp, they muſt give a blow or two with a ſtaff vpon the ropes, to part them a ſunder, one from an other, that each may beare an equall weight.

If you perceive that your *Fearne* beginnes to give back, then you muſt preſently let your peece ſinke, and underlaye, and ſettle well the feete of it, and that as gently as may be, to the end the *Croſſe beame*, or Rouler may not be disjoynted, or broken.

Finally, giving two or three turnes to the *Maine rope*, vpon the *rouler* or winder of the *Fearn*, you muſt wind it vp carefully, and very gently with the help of two men only: in ſuch ſort, that when one of the levers or handles hath gone about, the other muſt be held faſt till that the other man hath putt his in its place to make likewiſe its turne about: or elſe the other man ſhall ſtay his hand, till that his fellow drawing out his, hath put it alſo in its hole; which muſt be done ſo often till the peece be hoiſed ſo high, that you may put your Carriage vnder it.

Alſo you muſt take heede that your peece knocketh not againſt any part of your *Fearne*, which might cauſe any *diſaſter*, or that the *Fearne* might breake, and letting the peece fall, a miſchiefe may happen, and put all into diſorder: wherefore you muſt put the carriage under it very gently, that the *Tronions* may fall juſt into the holes or claſping ſockets of the carriage and ſo guide your peece by the beame which it hath in its mouth, that it falls ſoftly to reſt upon its carriage, and then locking it well in, and faſtning it with the wedges, you may then looſen your ropes, and taking away the *Fearne*, your peece being thus mounted you may draw it whitherſoever you pleaſe.

HOW A CANONIER OVGHT TO CHARGE A PEECE.

CHAPTER VI.

A Peece being brought to a *Batterie*, and planted upon a *Platforme*, having powder, bullets, his linſtock, ſcowrers, Rammers, and all things elſe in a readineſſe, after he hath ſtuck down his linſtock in ſome place under the winde, and firſt carefully cleared his peece with his ſcowrer and sheepe-skin within, and ſees that the touch-hole be not ſtopped, or any duſt or filth cleaving to it, then one of his Companions, which is to aſſiſt him, (for commonly there muſt bee two Canoniers to every Canon, or great peece of Ordnance) brings him the *pouch barrell*, with powder iuſt before the mouth of the peeee, and putting his Ladle or charger into it, fils it, and leaſt it might be overfull, giues it a little iogg, that the *Surplus* may fall down againe into the barrell, after this he puts it gently into the mouth of his peece, even till the end of his Ladle comes up to the very brich and touch-hole of his peece, and then turnes his Ladle ſoftly, and lets it lye within the chamber of the peece, and drawing out his Ladle almoſt to the mouth of his peece, puts it back againe to take up the looſe cornes which were ſpilt by the way, and to bring them up to the charge of powder: this done he drawes out his Ladle, and takes out of the *pouch-barrell* a ſecond Ladle full (for by triall before, he knowes the weight and charge of powder, which his Ladle will hold, and which his peece well require) and ſo putting in his ſecond Ladle full up to the former, drawes it out, and doth as he did before, that no looſe cornes may lie in the bottome of the mould of his peece, and in drawing out of his Ladle, he muſt haue a care, that he let fall any powder upon the ground, for it is a thing unſeemely for a Cannonier, to trample it under his feete. Then he takes a wiſpe of ſtraw, hay, or any other thing: and puts it ſo hard into the mouth of the peece (turning his ladle to come to the end of his Rammer) hee driues up the wispe and carries up with it the looſe cornes, which happily may be by the way in the mould of the peece, even up to the charge of powder, and then giving the ſtopper and powder, two or three shoues, to make it lie cloſe together in the chamber of his peece, he drawes out his Rammer, puts in his bullet, which roules gently into his peece up to the wiſpe or ſtopper which keepes up the powder (all this while his *Companion* ſtopping the *touch-hole* with his finger, that no powder flies out of it, but that it be alſo well fild and ſtopt with powder which hee may do out of his *touch-horne* afterwards) and then puts in his ſecond wispe after his bullet. And the Canonier is to be forwarned, that he ſtands not iuſt before the mouth of his peeee, while this is a doing, but aſide of it, leaſt a danger or miſchelfe might happen to him, and thus the peece having its due charge both of powder and bullet, he ſhall cover his touch-hole with a dry sheepskin, after he hath levelled his peece, and ſetting away his pouch barrell of powder with the reſt, in ſome *Concaue*, or hollow hutt into the ground covered over with ſodds or earth, he ſhall attend the Gentlemans of the Ordnance his command before he giues fire.

An other obſervation for a Canonier.

Touching the charging of a peece *Frons-berghen* maintaineth, that one ought to take in powder one half of the weight of the Bullet. Rivius and ſome others are of the opinion, that the more powder one puts in, the ſwifter and further the bullet wil fly shewing many reaſons to proue it. But experience the miſtris of this Art teacheth us otherwiſe: for a peece being loaded with two third parts of the bullets weight in powder, ſends the bullet going more ſwiftly, and will carry it further, which hath bin ſo often tryed, that it is without all contradiction, giving this reaſon, that the *exhencia* is ſo ſwift and violent, that it burſteth out of the mould before the two third parts of the powder be fired, and this hath beene found irrefutable.

Again others maintain, that if one ſhould forcibly ramme in the bullet then the powder might take fire, ere it could caſt out the bullet, and then would cauſe the bullet to fly further then otherwiſe it would do, but you muſt conſider in ſo doing, you either indanger the breaking of your peece, or elſe make it crooked and unſerviceable, becauſe your ordinary peeces will not bear ſo great a charg of powder, this hath bin tryed upon the Sea ſtrand at Scheve-

ling by the Hagh in Holland, before his Excellency prince Maurice of famous memory, where firſt one and the ſame peece was loaded with ten pound of fine powder to ſee how far she would carry her bullet. The place being marked where the bullet reſted, shee was loaden again with 9. pounds, which shot as far as the ten pound did, but laſt of all shee was charged but with 7. pounds of the ſame powder, which carried her bullet further then the two former shots: whence one may obſerue, that a peece of Ordnance may be overcharged, and therefore a good Gunner ought to haue a ſingular care to giue his peece her due meaſure and charge.

Of the Gunners ſervice in generall.

NOw foraſmuch as Ordnance are Engins of force, reaſon, waight, and meaſure: and the Gunners men exerciſed and experienced in them and their aputenances, in making platforms with defences, Troniers, Gabbions, Loopes, Parapets of earth, and Faggots about 23. or 24. foot high, of Faggots of 2. foot high of earth, bed upon bed vnto eleven foot high, and after 3. foot of Terraplene, to raiſe the Troniers and Loopes, ſo that for the Canon it be 3. foot wide in the Barb and within 12. foot wide without the lower part therof to deſcend ſcarpwiſe the better to diſcover the Enemies avenews, and offend them the more freely, for avoyding the blaſt and ſmoake, and ruine, it would elſe make: For the Culverings 2 foot and a halfe within, and 9 foot without will ſuffice, and for leſſe peeces, leſſe meaſures. If the Battery be to be made with Gabbions, they being filled with earth without ſtones, moiſtned, and rammed 7. foot a peece in dyametre, 3. rankes betwen 2. peeces, if the place will permit or 2. at the leaſt, and 3. rowes alſo one before another, ſetting one betwen two, ſo if the 1. ranke haue 3. the ſecond will haue two, and the third one, but it will be hard to make a ſafe Battery with Gabbions, Canon, or Culvering proofe: And each platforme is to haue 30. foot for the reverſe of the Canon, and 27. foot for the Demy Canon, he ought to ſee that it be levelled, or riſing 1. foot for 20. backwards the better to ſtay the reverſe and facility, the bringing the peece being loaded to the Loop: He ought to ſearch and examine, the goodneſſe of the peeces, their Ladels, Rammers Spunges and Tampion, fitneſſe and roundneſſe of the shot, force and goodneſſe of the powder and match; And to ſee all fitted accordingly, and to place the powder covertly, hid ſafe from the fire of his owne as alſo of the Enemies Ordnance, to ſee the Gunners take their markes toward the under part, giving each under Gunner his charge.

HOW A CANNONIER OVGHT TO LAY AND Levell his Peece and to amend a bad shott,

CHAPTER VII.

HAving time and Command to lay and Levell a Peece, according to the ordinary ayme, to try how farr it will carry, the *Canonier* shall take a long ruler, and laying it vpon the midſt of the *Frizes*, aſwell of the brich, as of the *muzzle* of the peece, and a levell upon it, he shall raiſe or ſinke it, untill the plummet of the Levell be iuſt in the midſt: then taking away both the Ruler and the Levell, he shall ſee even with the Frizes, the point or marke which this ayme diſcovers, which without doubt will be the place it wil carry to; with which according to the levell of the mettell, whereof wee will ſpeake hereafter, it will make but the half. But if he hath no leiſure ſo to uſe the *Ruler* and *Levell*, he may take his ayme, or lay his peece, as he finds good, according to the charge and proportion of his peece. If he ſtrickes his marke, he may then be aſſured, that his ayme is right, and uſing the like weight of powder, will alwaies make the ſame shot.

But if his bullet carries over, he shall level his peece againe as he did before, and having got the firſt marke in his ſight, he shall neither ſtirre nor mooue his peece: but shall take away aſmuch of the *Frizes* of the brich, till he ſees the blow which the bullet gaue, and which will bee the true, and right ſight, which he preſently may trie by laying his peece upon his firſt marke, which without any doubt he will ſtrike.

Now if his firſt shot fals short, then he muſt doe as he did before, levelling his peece again and then without mooving it, he shall goe and take away the *Frizes* from the *muzzle* till hee diſcovers the blow of the bullet, and then he shall haue the true ſight; according to which, laying his peece upon the firſt marke, hee will ſurely ſtrike it, if that there bee no fault in the powder.

There is an other way of levelling of a peece, and amending of a bad shott, in adding or diminishing the elevation, according to diſcretion. To witt, when he shootes short of his mark, the peece is remooved and layd as before, afterward he raiſes up the *Muzzle* as he shall judg, and as need shall require, that he may ſtrike his deſired mark, obſerving well alwaies how much this elevation is made higher then his firſt ayme taken, which he shall perceiue if looking even with the mettell, he shall ſee what marke it will show him.

How a Canonier ought to Levell his Peece.

Then giving fire, and ſtriking the marke before aymed at, he may be aſſured, that his peece carries right, to which henceforward hee shall giue as much height aboue the naturall Levell: if it failes, that is, if he over shootes his marke, let him diſpart that which his firſtshot fell too short, with the length of the ſame, for the leſſening of the Elevation proportionably; in doing whereof, without all queſtion hee shall ſee his shott remedied, and a right shott made. And this is your common and ordinary way in which Gunners do moſt exerciſe themſelues in, with aſſurance that he which knowes not by this meanes to giue the right elevation and range to his peece, is not worthy of the name of a *Canonier*. Now for his better underſtanding I will giue him this example.

Suppoſe a *canon* be mounted upon his carriage, and planted upon a *plateforme*, and is to mark a shot at ſome *white-ſtone* or marke in a Wall. To doe this, your Gunner muſt take his ayme as curiouſly as poſſibly he can Levell with the mettell of his peece, but if his shot fals to short, to helpe it he shall take his ayme againe, and shall lay his peece as hath beene taught before: afterward he shall raiſe it a point higher, ſo that whereas he had but 6. before, now he hath 7. points of the elevation, and afterward giues fire. If he ſtriks his mark let him alwaies take the ſame ayme and Levell, But if he over shootes his marke, let him levell his peece as is taught before: by diſparting the difference of the firſt, from 6. with that of ſeven points, as diſcretion shall guide him, according to the carriage of the firſt shot, and giving fire, (without all doubt) he shall hit his deſired marke. And his Peece being thus raiſed he muſt keep in his ſight the point or marke which is showne him, and obſerue wel the height which is aboue his marke, with aſſurance that when he is to make more shot by keeping this elevation he wil never faile. But if the firſt shot lying upon the 6. points be to high, then he shall helpe that by the ſame Rule in laying his peece lower, and ſo shall ſtrike his marke whereby he shall get credit and commendations for it.

A new deviſe by any ſtaffe, to levell, mount, and imbaſe any peece.

ALſo any peece may with a field Linſtock, Rammer, or Spunge, or other ſtaffe be mounted to any degree of the Quadrant, being thus prepared, firſt mark from one end of that ſtaffe a diſtance equal unto the height of the pomel or caskabel of the peece, placed levell upon her platform, & then take the diſtance between the centre of the Tronions, and the pomell or caskabell, which make or imagine a ſemidiametre of a Circle, and divide it by diagonals or paralels, or otherwiſe into a 1000. equal parts. Laſtly out of the table of Sines, take the number anſwering to every degree out of the ſaid 1000. parts, and ſet that diſtance from the ſaid mark downwards, and if the totall Syne of the table be 100000. omit the two laſt figures of each number thereof toward the right hand, and if it be 10000000. then omit 4. figures of each number you find in that Table, and the remaining number will ſhew how many of thoſe 1000. equall parts are to be ſet downwards from the mark beneath the ſaid levell for each ſeverall degree: Then drawing alſo 10. paralels or diagonals from the firſt degree to the ſecond, and from the ſecond to the third, &c. ſucceſſively continued from each to his next, noting every degree with Arithmeticall characters, ſo you may from ſix minutes to ſix minutes by thoſe right ſignes mount the peece, ſo ſet forth for any peece which it ſhalbe prepared for. This may alſo be deſcribed upon ſuch a ſtaffe without the table of ſynes in a mechanical manner thus, If you deſcribe a Quadrant or quarter of a circle with a ſemidiametre, equall to the diſtance from the centre of the trunions, to the centre of the pomel or caskabel, & devide the Arch of that quadrant into 90. equall parts or degrees, and then from each degree letting a line fall perpendicularly upon the baſe ſide of the ſaid quadrant, and laſtly, each of thoſe right lines being thence transferred from the ſaid firſt marke downwards upon the ſaid ſtaffe, and marking them with arithmeticall figures for each degree, thereupon making alſo paralels and Diagonals as aforeſaid, you may thereby Geometrically and mechanically marke the ſame from *6.* to *6.* minutes as before. The uſe of them is plain and eaſie, for if you bring downe the centre of the caskabel or pomel of the peece to any number of the degrees thereon ſo marked, for that peece, you ſetting the lower end of the ſtaffe to the platform being even, although it be riſing or deſcending backwards, I ſay then the axis of the bore of that peece wilbe found to be elevated to the degree aſſigned: If you be to imbaſe the peece, thoſe lines and number alſo ſet above the firſt named mark, will perform the like office there, in the thing required.

OF A QVADRANT LEVELL, AND OTHER Inſtruments for Ordnance, and the uſe of them

The forme, proportion, and making of a quadrant and a Levell, with an inſtrument to ſhew the uſe of it, is very neceſſary for maſter-Gunners; *and* Canoniers, *for the Levelling and ayming of Canon, other Ordnance, and Morters demonſtrated in the fift plate, and 15. 16. and 17 figures following.*

CHAPTER VIII.

TO make a *quadrant*, as is fitting, one muſt firſt make the whole circle marked 1. which is devided by lines, running from its *center* into 48 equall parts; at the end of each is noted the number thereof, incloſed in a ſpace between two little lines within an other circle, and between two *Vergets* or ſmall *rings*, where you ſee there is a ſpace alſo, by which the ſaid line is devided equally in the midſt.

With a quarter of this circle is made your *Quadrant* marked (2) being from *I* devided into twelue points, making ſeven degrees and a halfe, ſo that in all they make 90, which is iuſt the fourth part of the 360 degrees of the whole circumference of the world.

It may alſo be devided, as you ſee upon the white, each one the outſide, into 45 points, wherof every of them make 8 degrees: ſo that the whole 360 degres are comprehended within them, according to this *form* and deviſion is made your other *quadrant*, noted (3) and is marked with, *A. B.* and *C.* devided into 9 equall parts, each of theu making 10 degrees.

Now by theſe two *quadrant*, the plummet hanging in the midſt from the point of the 45 degree, which are alſo devided into two equall parts, is showne to you the higheſt elevation and range of a peece, yea as ever the peece is able to carry at length, as you may ſee in the figrues following of a Canon and a Culvering.

The like is alſo showne you by the *Levell* marked (4) for the ayming, and levelling of peeces, when you are to take your maike aright, which alſo is uſefull for the making of your *platformes*, and beddings for Ordnance, all which are neceſſarie for the Art of Gunnerie.

This may alſo be made by a *quart* of the former Circle, if you devide it into 12 equall points, and ſo noted and ordered, that you muſt beginn to count from the midſt of it, towards the ends or ſides to the 6 point, ſo that your *plummet*, being upon the 6 point iuſt as the others, you shall, finde that your peece is layd at its higheſt elevation and range.

The *Cartabon* (or your foureſquare levell) marked 5, comprehends alſo all the circle abouesaid, and is devided into 48 pointes, according to the foure quarters of the world, that is, *Eaſt, South, North, and Weſt*, making alſo foure particular *Quadrants*, whereof the forked dart comming from the center or midſt; showes all the lines, not onely of the *Circle*, but alſo of the *Quadrant*, or your foure ſquare levell, and running in a line from the midſt, marked with O and N or with O and S, it will make a *Levell*, and is in the firſt degree of the right *Quadrant*, but comming from the midſt, and betweene the ſaid lines, it will ſhew you your higheſt elevation, as the other Quadrants haue done. The handle noted *E. F.* (if it be poſſible) muſt be 2 foote and a halfe long, whereof each foote muſt be 16 ynches, to the end it may make iuſt 40 inches, that in 3 foote and foure inches of our ordinary foote, which is an ordinary pace, or halfe a Geometricall one.

Of a Quadrant Levell, and the uſe of them.

Each of theſe ought to haue in the midſt, and at the end a little hole going from the one ſide of the handle to the other, which ſerue for this uſe, that this inſtrument being ſet upon the brich of your peece, looking through one of them aboue the higheſt *Frizes*: you may giue a shreud geſſe how farre your peece will carry the bullet, according to the length, condition, and proportion thereof. The two pins which you ſee on the ſides of it, marked C F ſerue to this end, that thereby you may diſcerne the quality of the place, which you would meaſure, the point deſſigning by its fall from the Eaſt towards the North, the length, bredth depth, and height of the ſame. Finally this inſtrument contayneth many miſteries of great conſequence, and is of excellent uſe both for an *Inginer*, and a *Canonier*.

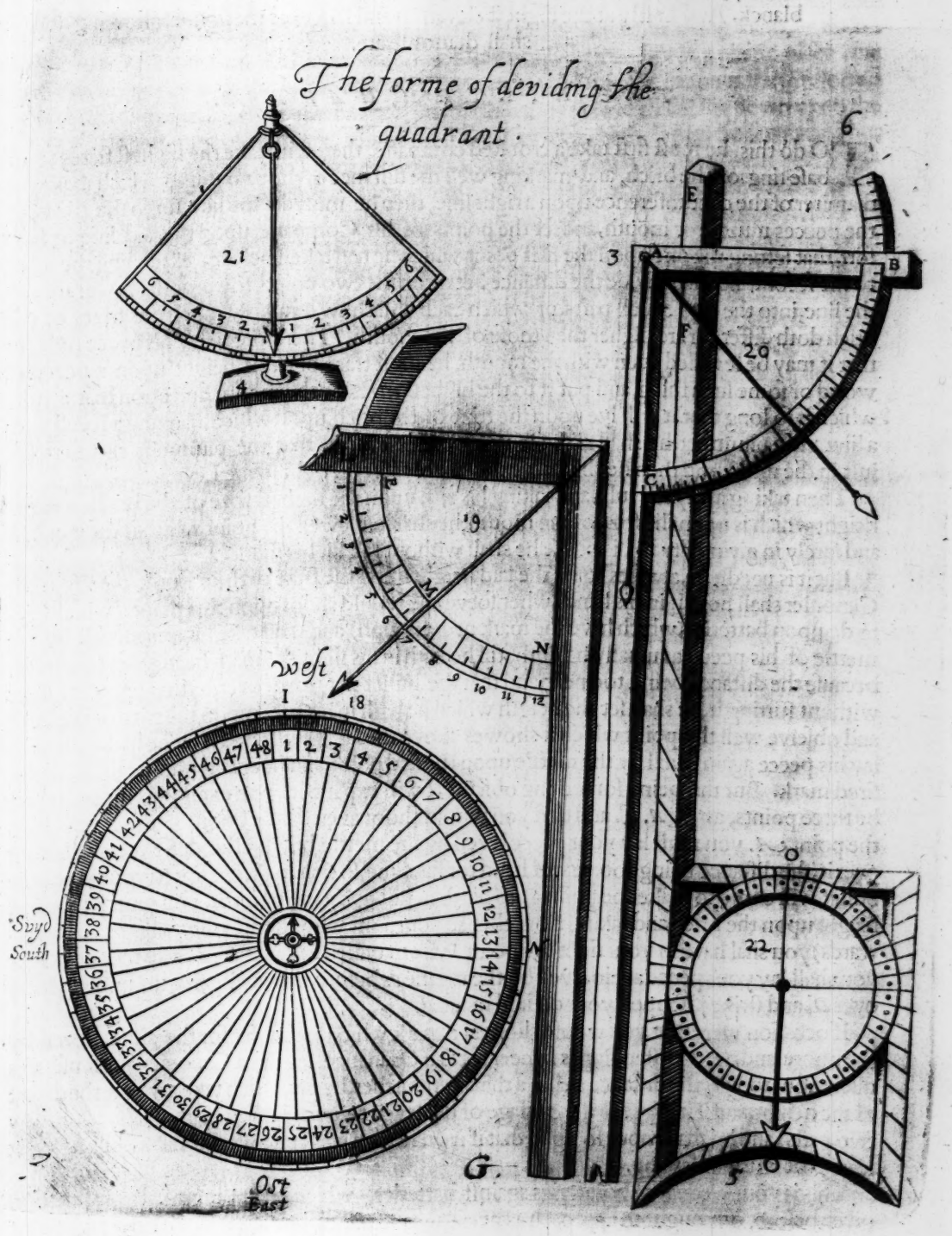
The common rule, whereby a *Canonier* may know how farre his peece will carrie, and how farre from one degree to an other, according to the *elevation* thereof, let him firſt ſee how many

paces it will carry being laid even with the mettle, which afterward he shall devide by 50. and multiply the Quotient by 11. and that will bring out the number of the further digreſſion or range, which if he devides again by 44. he shall then find the quotient to be the juſt number of paces which the bullet will looſe in the other ranges, degree by degree, as for example A battering Canon will shoot its bullet being laid even with the mettle a thouſand ordinarie paces, at two foot and a half the pace, which being devided by 50. your quotient will give 20 which being multiplyed again by 11. it will give 220. paces, which is the number of the next digreſſion, made in the ſecond degree of the quadrant, or the firſt after the Levell aboveſaid.

But all the other digreſſions or ranges, do alwaies diminish even unto the 45. degree. To know then what this diminishing is from degree to degree, even unto the 45. which is the higheſt elevation, you muſt take the juſt number of the digreſſions from the firſt to the 45. which will be 44. now deviding them by the former number of 220. paces, you shall find your quotient to be 5. which is the number which goes alwaies, decreaſing from the firſt to the laſt digreſſion, ſo that your Canon being laid upon its naturall mark, in which it is raiſed a degree above the Levell, even with the mettle, making a 1000. paces as is ſaid, being laid upon the ſecond degree, adding 220. paces to it as an advantage, then it will carry the bullet 1220. paces before it ſtops. Again, you may add the ſame to the third degree, but the former being the greateſt digreſſion, as we have taught, this then, and all the others will alwaies diminish 5. paces, and will make but 215. above the 1220. of the ſecond degree, ſo that you shal have in your third degree 1435. paces. in the fourth degree 1645. in the fift degree 1850 paces, in the ſixt 2050. paces, in the ſeventh, 2245. paces, in the eighth, 2435. in the ninth 2620. paces, in the tenth degree which is the firſt of the quadrant of 9. points, it will be 2800. paces, in the eleventh, 2975. in the twelft, 3145. in the thirteenth, 3310. in the fourteenth, 3470. paces, in the fifteenth, 3657. in the ſixteenth, 3775. in the ſeventeenth, 3920. in the eighteenth 4060. in the nineteenth 4595. in the twentieth degree, which is the firſt of the ſecond point, 4325. paces, in the one and twentieth, 4450. in the two and twentieth, 4570. in the three and twentieth, 4685. in the twenty fourth, 4795. in the twenty fift, 4900. in the twenty ſixt, 5000. in the twenty ſeventh, 5095. in the twenty eight, 5185. in the twenty ninth 5270. paces, in the thirtieth which is the beginning of the third point, 5350. paces, In the thirty one, 5425. paces, in the two and thirty, 5595. in the three and thirty, 5560. in the four and thirty, 5620. in the five and thirty, 5675. in the ſix and thirty, 5725. in the ſeven and thirty 5770. in the eight and thirty, 5810. and in the nine and thirty degree, 5945. paces, in the forty point which is the beginning of the fourth point, 5875. in the 41. 5900. in the 42. 5920. in the 43. 5935. in 44. 5945. Laſtly in the 45. when you reckon but foure halfe points of the quadrant, you have the higheſt elevation or range, as you shall ſee in the figure following, which maketh 5950 paces.

To conclude, a skilfull Canonier exerciſing himſelf herein, will eaſily conceive and know certainly how to levell his peece upon any one of theſe degrees and points, and how farre it will carry, be it great or little: for this calculation will never fail him, by obſerving this, that in giving the chaſe or elevation of his peece, in what point ſoever it be of this rule or degree reaches from 1. inch to 16. which is a Geometricall foot. *The next chapter following shall shew you the uſe of it in levelling of Oranance after three manner of wayes, to wit, even or levell with the mettle, point-blanke, or upon a higher elevation at a range.*

The forme of devidmg the quadrant.



SHOWING HOW A CANNONIER SHALL Shoot levell by the mettle of his peece, otherwiſe called the *Horiozontall Levell.* Secondly, or by the *Levell Axis* vulgarly called by ſome Gunners the levell point blanck. And Laſtly at the higheſt elevation and range, as the figure following ſhall demonſtrate.

THE NINTH CHAPTER.

TO do this, he muſt firſt take a crooked compaſſe, therewith take the higheſt frizes to or baſe ring of the brich, and marking well the diſtance of the two points which make the diamiter of the circumference upon a right line, then he muſt do the like upon the frizes of the peeces muzzle or mouth, and ſet the points of his Compaſſe upon the ſaid line in ſuch ſort, that ſetting the one upon the firſt point which he had taken before, extending the other to the ſecond, he ſhall divide the diſtance between the two points towards the lower part of the line, into the two equall parts, of which each will show him how much the frizes of the brich doth differ, or are higher then thoſe of the mouth. Therefore to lay his peece right, ſo that it may be levelled even with the mouth, he muſt trace out this height upon a peece of wood or ſome ſuch thing, and put it to the higheſt frizes of the mouth, and upon that a rule, which is ſo long that it will lye upon the frize of the brich, upon which, hanging a levell with a line and a plummet, he ſhall raiſe the peece or ſinck it, till that the plummet comes to fall juſt in the midſt, and then he ſhall have the boore thereof, right in the Levell.

Then taking away the rule, and taking his aim upon the higheſt frize of the brich, and the height which is upon the frize of the mouth, he ſhal mark well the point which it showes him and furely in giving fire to his peece he ſhall without fail hit his mark.

But it is needleſſe alwaies to ſet the ſaid height upon the frize of the mouth, therefore the Canonier ſhall hold it in his hand, whenſoever he would ſhoot upon this point (which he is to do upon batteries, which have the mark neer enough) and ſhall take his aime levell by the mettle of his peece, as uſually he doth, till he hath in his ſight the mark he meanes to hitt, but becauſe the diſtance being too near, and that the bullet may carry over, letting his peece ſtand without ſtirring it, he ſhall ſet the heigth which he hath in his hand upon the frize of the brich and obſerve well the point which it showes above the ſaid height, and after he hath it, he ſhall lay his peece again levell by the mettle upon the ſaid point, and he ſhal without fail hit his deſired mark. But this being ſomething obſcure, I will explain it by an example, Suppoſe there be three points, as *D. A. C.* and that you would ſhoot even by the boore of the levell upon the point *A.* you muſt lay your peece levell by the mettle, but queſtionleſſe you ſhall ſhoot over it, the diſtance being too near at hand for his aime, ſo that in giving fire to your peece the bullet will come to ſtrike the point *C.* to hit then juſt upon the point *A.* you muſt ſet the ſaid height upon the brich and taking from thence your aim (without moving your peece downwards) you ſhal have in your ſight the point *D.* from which having taken away the ſaid height you ſhall lay your peece again levell by the mettle as before, and giving fire, the bullet will fly over *D.* and ſtrike juſt upon your deſired mark *A.*

If occaſion were that you would ſhoot at a mark which is too far for the aime, levell by the boore, and notwithſtanding is ſo neer for the Ordnance levell, a Canonier muſt uſe this diſcretion, to wit, the diſtance being a third part further, he muſt then take away a third part of the height, and if it exceeds the carriage of the levell two parts, then he muſt alſo take away two parts, and he ſhall ſnoot ſo right, that if it were for a wager he would hit a ſhilling or at leaſt a hat without fayling.

This is your Ordnance pointeries againſt batteries, which according to the inſtruction given before, one ought to approach as neere an enemie as one can, ſo that if you do not take

take heed to lay alwaies this heigth upon the brich of your peece, you will alwaies ouer-shoot your mark, contrary to the deſire of a good Canonier, which is alwaies to beat upon the foot or foundation of a wall, that it may tumble down, and be battered the ſooner, for the eaſier entrance of a breach, obſerving that it is one of the principalleſt conſiderations in all ſhoots, that in making a good ſhot one levels his peece at the foot of his mark, eſpecially in ſhooting at a troup of horſe, or a company of foot. But in a ſtony place, a Canonier doth willingly ſhoot ſhort, becauſe in ſtriking upon the ſtones or bricks in razing them, he makes a hole much greater then the bullet which goeth through them. But in a plaine place one muſt lay his peece ſo, as the bullet may take them iuſt in the middle, or about the girdle, and ſo may kill a whole file, or a rank at a ſhot, yea though they ſhould all fall flat down upon the ground, yet they cannot all eſcape, otherwiſe if you levell too high, it may be accounted but as a loſt ſhot. To amend then a ſhot too high for this mark, you muſt levell your peece upon the white or marke you ſhoot at, then going to the mouth of your peece with a levell line and a plummet, and take there the height of the higheſt frize or ring to the bottome of the boore, which you ſhall ſet to the frize of the brich, and from thence, and aboue the frize of the mouth, you ſhall take (without ſtirring the peece) your aime, marking well the place it will ſhew you, then taking away the ſaid heigth, you ſhall lay your peece againe upon the point it ſhowed you, and ſo without fayling, you ſhall hitt the mark you deſired. But if you peece carries to ſhort, it muſt be amended in this manner, lay the peece as before, then going to the mouth with your line and plummet, take all the heigth of the frize from the top to the bottome, in ſuch ſort, that your line may take the whole Dyamiter of all the circumference thereof, and by this dyamiter, you ſhall take the thickneſſe of the mettle from the bottome of the boore, even to the loweſt part of the ſaid frize, and laying this heigth upon the brich of the peece, and levelling it upon the mark deſigned, which you would ſhoot at, you ſhall ſee the good effect it will take: now for a ſhot that is made on either ſide of your mark, it is to be helpt in this manner following, if the bullet fals on the right ſide of it, then you muſt lay or moove your peece, and take your aime ſo much on the left hand, and that you may not faile a hairesbreadth, now to make the diſtance of the other ſide alike, you ſhall level your peece as before, right upon your white, then take a long ruler, which you ſhall lay upon the frizes, aſwell of the brich, as of the muzzle, and leaving it upon the mouth, you ſhal take your aime removing it at the brich ſo long, till you haue got in your ſight the place of the ſide ſhot which your bullet made, and without taking away your eye, or your hand from this ſight, removing the brich of your carriage, till the brich of your peece, comes to be right in the midſt under the ſaid ruler, which being done, take away the ruler, and take your aime level by the mettle of the peece, and you ſhall find your peece to be turned iuſt as much towards your left hand, as it ſhot before on your right hand. Moreouer, there are many occaſions, which may cauſe a bullet to ſtraggle either on the one ſide or on the other. The firſt is, when the boore is boored more on the one then vpon the other ſide, or by reaſon of the inequallity of the mettle, or that the mould is not right: this cannot be imputed a fault in the Canonier but in the Founder: neuertheleſſe, if he be ingenious, he may helpe this fault by his diſcretion trying his peece by his creuſet in, or ſcaling primer, and ſo help it as the fault may require.

A Peece alſo will carry ſidelings, if the tronions be not iuſt right the one ouer againſt the other. Alſo if the platforme be not layd even, but that the one part is higher then the other.

Item if a Canonier it taking of his aime ſtirs his eye from the iuſt middle of the frizes of the peece, and though he hath it, yet he may faile in not taking his aime iuſt in the middle of his mark.

Item if one wheele be higher then the other, the ſhot will fly alwaies toward the lower ſide.

Item if one of the wheeles ſhould ſtay upon a naile, and the other not, as likewiſe when the one turns more eaſily then the other, and if one wheel ſhould ſtand upon dirty ground and the other on hard, or when one of the Cubes or heads of the wheele is longer then he other.

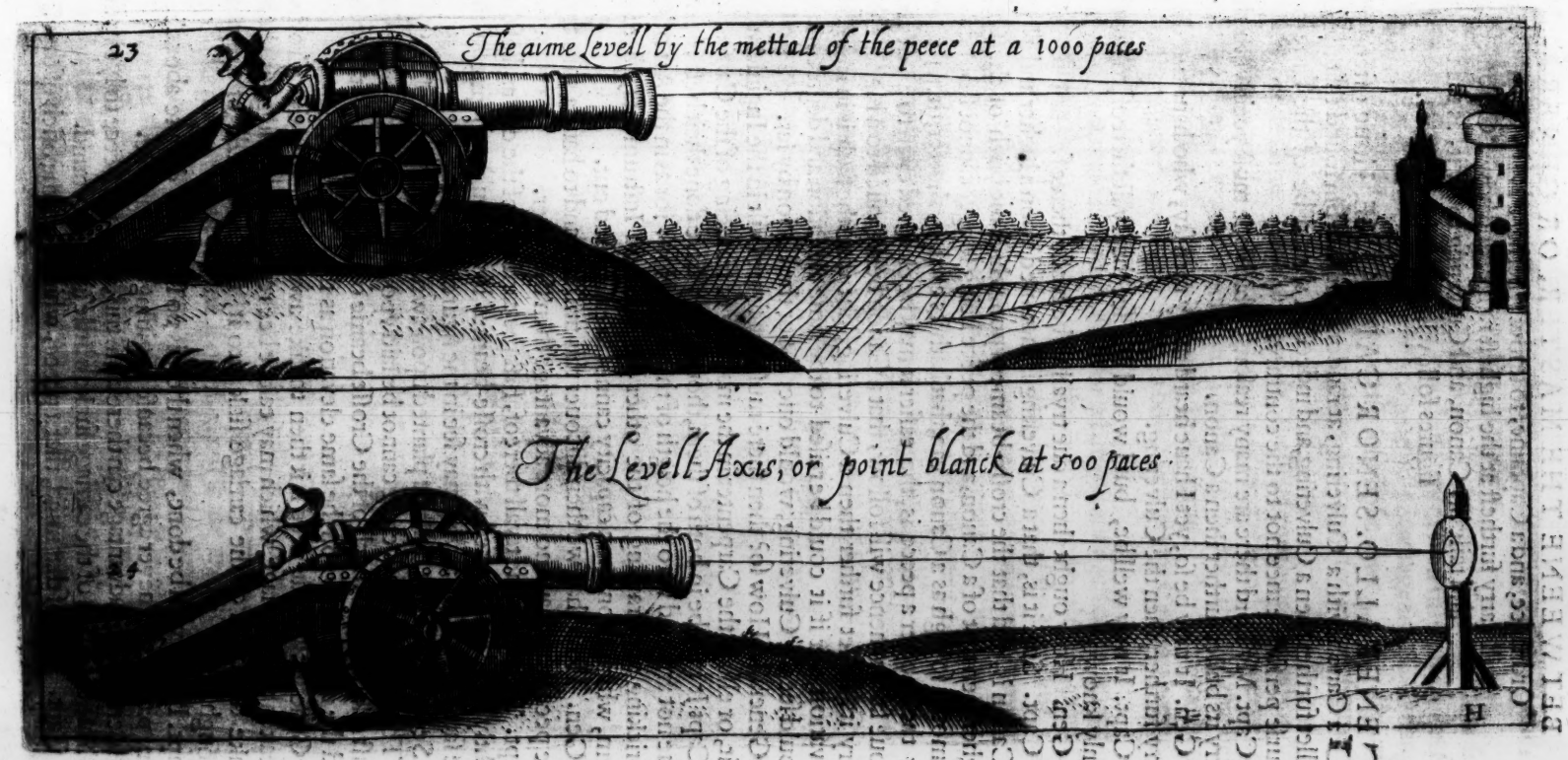
Item When the bullet is not driven home alike, or lies more upon the one ſide of the boore then upon the other: And Finally, the ſtraying of the bullet upon the one ſide may be cauſed by the vehemency of the wind, when it cannot be holpen.

Likewiſe a short or an overshot may be occaſioned either by the force or the weakeneſſe of the powder, or by reaſon of the unskilfullneſſe of the Gunner which knowes not to lay and levell his peece aright, neither knowes the true diſtance of the mark whereat he shootes.

All which I have marked at large, not as a matter to excuſe an unexpert Canonier but to give advice to the wiſe to have a vigilant eye upon all things, and to follow the rules above-ſaid, and ſo to prevent all inconveniences, for to faile the firſt time may paſſe, the ſecond may be pardoned, but the third time is too much, and cannot be excuſed, becauſe it is a certain ſigne of indiſcretion and want of iudgement; And indeed there is no fault which we have shown, but by diſcretion it may be remedied, whereof we have ſeen many examples at the famous ſiege of *Oſtend*, wherein a ſound iudgement was shown in this kind, whereof I will relate two examples.

A ship running into the haven to get into the Town, which brought the enemy ſome proviſion, a woman ſat at the helm to make us ashamed, order was given to a Canonier that he should make a shot at this Steereſſe, who thinking it was too cruell a thing to shoot at ſo weak a ſexe, offered to take away the helme from between her hands, and to make the boat come floating towards us with the floud, if she were not provided with an other, which he preſently put in practice, levelling his peece ſo right and diſcreetly, that indeed shooting of the helme it fell in the water, and the boat came floating towards our quarter, where it was pillaged and burnt in ſight of our enemies.

An other ship lying at anckor, ſtaying for a high water to come into the Towne, our men to ſinck it made many Canon shot at it in vaine, judging that the diſtance was too far to do it any harme, whereupon they were forbidden to shoot any more at it, and not to ſpend their powder to no purpoſe: But at laſt there came a Canonier who promiſed not onely to ſtrike the ship, but alſo to shoot the Cable in ſunder, ſo that by favour of the water the boat should come floating to our mercy, and indeed, levelling and giving fire to his peece, he shot the Cable in peeces, and to the great admiration of all our Army, the boat came ſwimming to our quarter. Theſe examples I have related and will do others in the following Chapters, to shew the skill of a good Canonier that hath diſcretion and judgement in ſuch occurrences, and to give encouragement to all Canoniers and Gunners to do the like when occaſion shall ſerve.


The aime Levell by the mettall of the peece at a 1000 paces
The Levell Axis, or point blanck at 500 paces
H

The first Dialogue.

BETWEENE THE MASTER, OR GENERALL OF THE Ordnance, and a Captaine, to know whether a Demy Canon or a Culvering will carry furtheſt at the higheſt range, and how a Canonier muſt levell, and raiſe his Canon, and Culvering to try it, as the two next figures following ſhall demonſtrate.

GENERALLO. SENOR CAPTAINE, I haue often heard that in trying of a Canon with a Culvering, at randome, it hath bin found that the Canon will carry its bullet further then a Culvering, and indeede I ſhould be of the ſame opinion, if your diſcourſe perſwade mee not to the contrary.

Capt. My Lord there are many reaſons, which one muſt yeeld vnto, that a Culvering will carry its bullet further then a Canon.

Gen. It may be ſo, yet I haue heard many men ſay, who haue tryed it, that a Canon will carry further, then the Culvering.

Capt. It may well be, but I would fain ſee the tryall thereof, to the end it might be certainly known.

Gen. How ought then a due tryall to be made thereof.

Capt. Sure it is, that a Culvering is mounted vpon a higher and a longer carriage, then a Canon is, and that the croſſe-beames vpon which the brich of the Canon reſteth, being higher then that of a Canon, and the peece being longer cannot ſtoope ſo much as to elevate its mouth ſo high as a Canon can, that hath its carriage shorter, then the croſſebeames lower, for the shorter a peece is, the eaſier it may be elevated even to 45 degrees of the quadrant aboue ſaid, whence will follow, that a Canon being raiſed to a higher elevation, muſt needs carry its bullet further then a Culvering, not that the fault is in it, but that it wants its due elevation, for if it could be raiſed to the ſame elevation and degree the Canon is, then you should ſee the Culvering, would ouer shoot the Canon by far.

Generall. How ſo? then there muſt bee ſome fault in the Inginier, that made the mettall of it, or elſe in the Carpenter in the makeing or frameing of the Carriage.

Capt It may be in both of them, though they haue done their beſt endeavour, becauſe they haue not attained vnto the heigth of this perfection: for as in the Art of Gunnerie, ſo in the fabricking and framing of the other Engines and Inſtruments, there are many ſecrets in them, which a common capacity cannot ſo eaſely find out.

Gen. How shall we then diſcouer this miſtery, and to haue a ſure tryall therof, that the one peece may haue no more advantage then the other.

Capt. To haue a true tryall thereof, firſt the carriages of the one and of the other muſt be ſo rightly fitted, and locked with croſſe-beames low enough, to giue both the peece one and the ſame elevation, as you may ſee in the figures following.

Secondly. They muſt be planted upon two plaine and euen plate formes.

Thirdly, if the Culvering cannot be laid vpon the ſame height as the Canon is, then you muſt take away ſo much of the Croſſe beame of the Carriage, that the brich of it may ſinck, and the muzzle lie vpon the ſame elevation as the Canon doth.

Generall. What need is it then to take away ſo much of the Croſſe-beames, and ſo to weaken the Carriage, which may eaſelie bee remedyed by digging a hole in the ground, to make the brich of the carriage ſink into it, till the muzzle of the peece be raiſed high enough.

Capt. It may well be done, when there is no ſtrife nor diſpute about it, to which the contrary parties will never agree, becauſe of giuing an advantage.

Gen. What advantage can there be in this, to haue a peece to lye vpon a plat-forme, and to haue the brich of the carriage ſunke a little into the ground.

Capt. I am of that mind, that a peece, which hath the brich of the Carriage ſtept from recoyling,

trary part is will never agree, becauſe of giuing an advantage.

Gen. What advantage can there be in this, to haue a peece to ly vpon a plate-forme, and to haue the brich of the carriage ſunke a little into the ground.

Capt. I am of that mind, that a peece, which hath the brich of the Carriage ſtept from recoyling, will shoot its bullet with a greater force and violence, then that which lies freer upon an explanado, or a plat-form, And therefore to giue no advantage to a Culvering, it is better to shaue of ſome of the Croſſebeames, to cauſe it to ſinke lower, then to ly in ſuch a ditch by raiſeing the muzzell to the required height as you may ſee in the figures following.

Gen. I haue heard diverſe diſputes among good Canoniers touching this point, Who thought that a Culvering, could not carry ſo farre as a Canon, becauſe this peece being long, the bullet muſt go a longer way from out the chamber to the mouth, and that before the bullet comes out, the powder in that while may looſe ſome of the ſtrength thereof, whereas a Canon being shorter, and the flying of a bullet out of the Canon shorter, the powder will ſend it going with a greater ſtrength.

Capt. I beleeue well that there is ſome reaſon for what you alledge for the length of a Culvering, and the shortneſſe of a Canon, when they are charged with that quantity of powder as their bullets require: but for your Culvering, in regard of the length of it, you giue it a greater charge, whereas for the charging of your Canon, you giue it in powder but halfe the weight of his bullet, and to an ordinary Culvering, you give it ⅔ in powder, or the weight of the bullet, but being a Culvering renforced, you may giue it as many pound of powder as the weight of your bullet.

Gen I will demaund of you Sir one queſtion more, and therewith conclude this diſcourſe: If you were to shoot at ships upon the Sea, what peeces would you chooſe to be beſt either your Canon or your whole Culvering?

Capt. Of this you may be aſſured from one that hath found it by experience, that there is no better peeces to do this then your Canon.

Gen. Giue me your reaſon?

Capt. Your Canon being shorter, may be laid lower, and better levelled, conſidering alſo that their bullets are weightier then the others, and fly more certain, becauſe neither the wind, nor the humidity of the water, can haue any ſuch great power to dead or hinder their flight.

Gen. How ſo? ſeeing your Culvering taketh a greater charge of powder, then your Canon, as you even now confeſſed is better, and will ding away the bullet with a more violent force.

Capt. My reaſon is that the wind and the moiſtneſſe of the water haue more power over a lighter, then of Canon bullet, which is heavier then a Culvering, now if you were to shoot at a ship of a like diſtance, you muſt raiſe your Culvering to your thinking two pikes length higher then the ship is, whereas your Canon will require but one pikes length of elevation aboue it. Therefore I haue made many a tryall of it at the ſiege of Oſtend, both of a Canon and of a Culvering.

Gen. Well Sir you haue ſatiſfied mee, and given mee good reaſons for what you ſay: but I pray you tell me whether a peece will carrie furtheſt, which is shot out of the Sea to the landward, or that which is shot from the shoare ſide, along the ſuperfices of the water

Capt. This were a hard queſtion to reſolue, if one had not made experience of it, Nevertheleſſe I will tell you what I haue ſeen, that wee shooting into the Sea from our batteries in Dunkirke at the Enemies shipping, which rid before the Town, we could ſcarce reach them, But I haue ſeen with admiration, that the Enemy shooting from their shipping to us ward, their bullets flew from that place, fiue hundred paces further, then ours did, where wee ſtood, yea ſome of them into the very Towne of Dunkirke.

Gen. Surely I was of a contrary opinion, thinking that a peece planted upon the firme

ground, the bullet would flie further, and with a more violent force, then that which is shot from a floating ship, becauſe the peece in recoyling shakes the ship, and by the shaking therof, the bullet may looſe ſome of its ſtrength, but theſe are ſecrets in nature, more admirable then apprehenſible.

Capt. True it is, that there are many hidden and ſecret miſteries in nature, but for this one may alledg ſome naturall cauſes: for a bullet shot from a ship to the land-ward, ſeeketh its naturall reſting place: but that which is shot from the land along the ſurface of the water, the bullet is forced to ſtriue againſt two elements, that is firſt againſt the aire, which retaineth it with all might, and ſecondly againſt the moiſtneſſe of the water, which alſo deads the bullet, cauſing it to ſtoope, for this hath bin found by experience to be true, that a bullet will shoot further into the Sea at a low water, then it will doe at a high Sea.

Gen. Jf a peece were ſo planted, that one could shoot both into the land, and alſo into the Sea, by turning the ſaid peece, the queſtion is, whether the bullet would flye furtheſt over the Land, or upon the Sea.

Capt. A Canon will carry its bullet a thouſand paces further over the Land, then it will do upon the ſuperficies of the water, and though we haue had no certain tryall of it: yet the ſiege of Oſtend hath taught us this experience, that we may be aſſured of it: For in the channell by Newport, when the battle in Flaunders was fought Anno. 1600. we shot at the Enemyes shipping and men of warre, to make them giue back, that our men might come up along the ſtrand with more ſafety, and leſſe danger to fight, we found that our bullets, which were shot at them from the land, could not reach them to doe them any harme, but the Enemies bullets, which were shot from their men of warre, shot amongſt us, and flew fiue or ſixe hundred paces over our heads.

Gen. That might well be, for perhaps the enemies peeces were either greater or longer then ours, or elſe that they had finer, and ſtronger powder then ours had.

Capt. The Calibres and boores of the one and of the other were alike, for their bullets fitted our peeces, but indeed in the goodneſſe of the powder there might be ſome difference, and for our parts to charge them well, we put a Ladle full of powder more then ordinary into ours, but this would not help. This queſtion J haue asked many times, both of Gunners, and Marriners, who haue given me alwaies this reaſon, that it was for ſome ſecret cauſe in nature, that a shot being made into the land, should fly further, then that which was made from the land into the water.

Gen. Though this troubled me a little yet I am glad to heare your reaſons, and the experience you have had. But J had almoſt forgotten to haue asked you one queſtion more, which now I call to mind how comes it to paſſe, that all the charge of the powder takes not fire, and is not conſumed in a Canon, aſwell as in a Culvering.

Capt. This is not any fault or advan tage in the peeces, for one would thinke that a Canon being shorter, and of a Larger bore then a Culvering a ſmall part of the powder might bee expulſed or driuen out before it be all fired, and that a Culvering being longe and ſtraight, might keept in the powder till it takes all fire, but this is done at a venture, and yet notwithſtanding it happens oftner in a Canon, by reaſon of the biggneſſe of the boore, then in a Culvering, for after you haue giuen your peece its due charge of powder to ramme it vp ſome what cloſe into the chamber of your peece, you give it two or 3 shoues with the end of your Rammer, the powder being well corned; there lies ordinarily ſome looſe cornes and duſt by the way in the bottome of the mould, which the wispe or ſtopping hath not driven home, ſo that if a Canonier, doth not take very good heed, there will alwaies be ſome part of the powder shed in the peece, which will ly before the bullet, and when the reſt of powder takes fire thoſe looſe cornes flyes out, and cannot take fire, like as you ſee alſo that ſome shreds and peeces of the ſtopping after the shot is made, and ſmoaks without being conſumed by fire. So that your *Lo.* may be aſſured that any peece of ordnance be it either short or long, if the charge of the powder be well ſtopped and rammed home and ſome

looſe

looſe cornes which will fly back gathered well up by the wiſp, there will not be ſo much as one Corn, but will all take fire. This is ſeen alſo in the tryall of Bombards and Morters, which though they be short, and large mouthed, fire and conſume, all their powder, without looſing ſo much as a graine.

Gen. Now I vnderſtand well, and confeſſe that hitherto I haue bin of the vulgar opinion attributing the cauſe to the shortneſſe of the peece and herewith we will conclude. Here follows the figure of a Canon and a Culvering elevated by levell vpon one and the ſame degree of the quadrant to try which will carry furtheſt at range.

Whether a Culvering or a Canon will carry furthest

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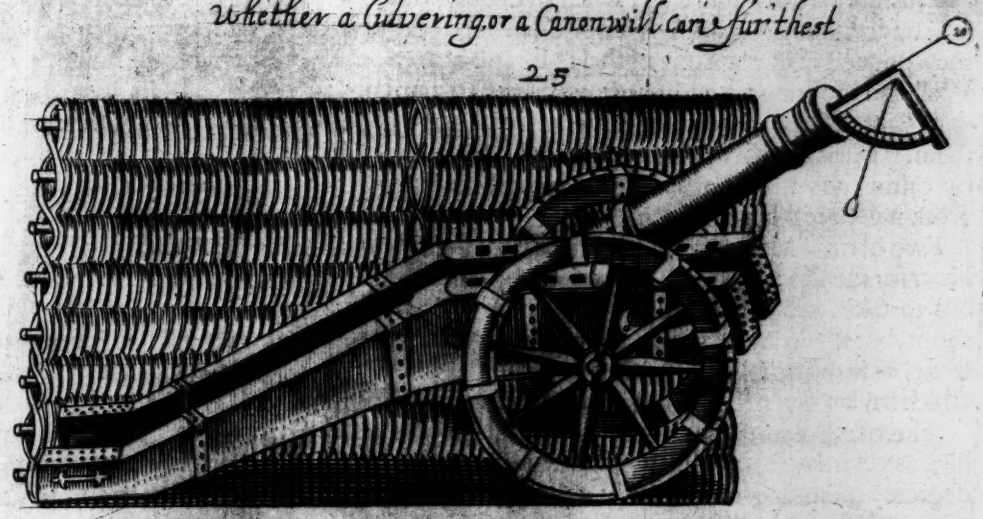

The Culvering will carry 7000 paces

The Canon 6000 paces.

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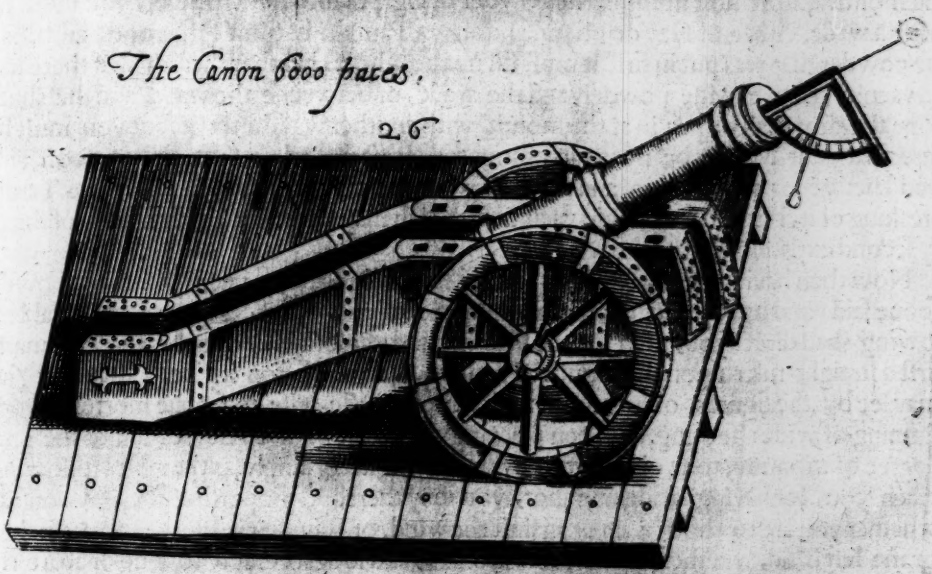


CONTAYNING THE DEMONSTRATION OF Morters, and the vſe of them.

THE TENTH CHAPTER.

YOUR great and ſmall Morters, are not onely ſerviceable in a warre offenſiue, by ſhooting and caſting of great *Granadoes*, as of a 100, 150, 170 pound weight, and ſmaller of 40 and 50 pound, but alſo by caſting of Fire-balles, ſtones, old rubbidge, and peeces of yron into Cities, Townes, and Fortreſſes, and may be uſed alſo defenſiuely, to be ſhot from Townes, and Forts beſieged, into any Enemies workes, and approaches, eſpecially they are of ſingular uſe, when an Enemy hath covertly approached, and lodged himſelfe under ſome Bulwark, Tower, or Turret, and is a beginning to undermine them, which if they do, you may plant one of theſe Morters at a reaſonable diſtance, on the inſide of your Wall, and ſhooting your *Granado*, as it were bolt upright into the aire, by its naturall fall, it may light iuſt into the Enemies workes, and there with great violence, breaking among them, it will make them cry, flye, and forſake the place, you may alſo fire them out of a place, by caſting good ſtore of *hand-granadoes* down among them, and ſo annoy them, that the work will be too hot for them.

Two of theſe Morters are repreſented unto you, in the plate and figurs following number. Now for the ſhooting away of your great Granadoes or Firebals, you muſt ever remember, but to take $\frac{1}{5}$ or $\frac{1}{7}$ part of fine powder of the weight of your grandoe or thing which you ſhoot, but if you are to ſhoot away a bullet without any fire workes in it, or ſome maſſie ſtone, or ſuch like ſolid thing, then you muſt take but halfe the weight of it in fine powder, which having given fire to the Morter, will ſend it going merrily.

The uſe of them is not to ſhoot in a right line, as other ordance doe, but in an oblique line, as you may ſee by the two figures following, unleſſe your morter be mounted to 90 degrees, mounting them uſually aboue 45 degrees, namely to 60 70 80. and ſometimes more or leſſe, as the diſtance, and fall of your Granadoe or ſhot ſhall require.

Having before ſhown you the making and uſe of the *Quadrant*, it remaines now, that I come to the charging and uſe of a morter, now before you put in your powder, it muſt be well ſponged and cleared, whether you charge it with looſe powder, or Cartouch, turning the mouth almoſt bolt upright, the powder being put into the chamber, you muſt ſtop it with a wade, either of Hay or okam, and after a Tamkin of ſome ſoft wood, and this with the powder that was put in firſt, it muſt fill up the whole chamber thereof, that there may be no vacuity, between the powder, and the wadd, or betweene the wadd, and the ſhot, this done the ſhot ſhall be put in at the mouth, with another wadd after it, but you muſt haue a care that your Morter be not much mounted, leaſt your ſhot flies out too ſoon, and the wadd between the Tampkin, and the ſhot will not onely ſaue the ſhot from the Tampkins breaking of it, but alſo is to avoid vacuities, which may endanger the breaking of the peece by ſecond expanſions.

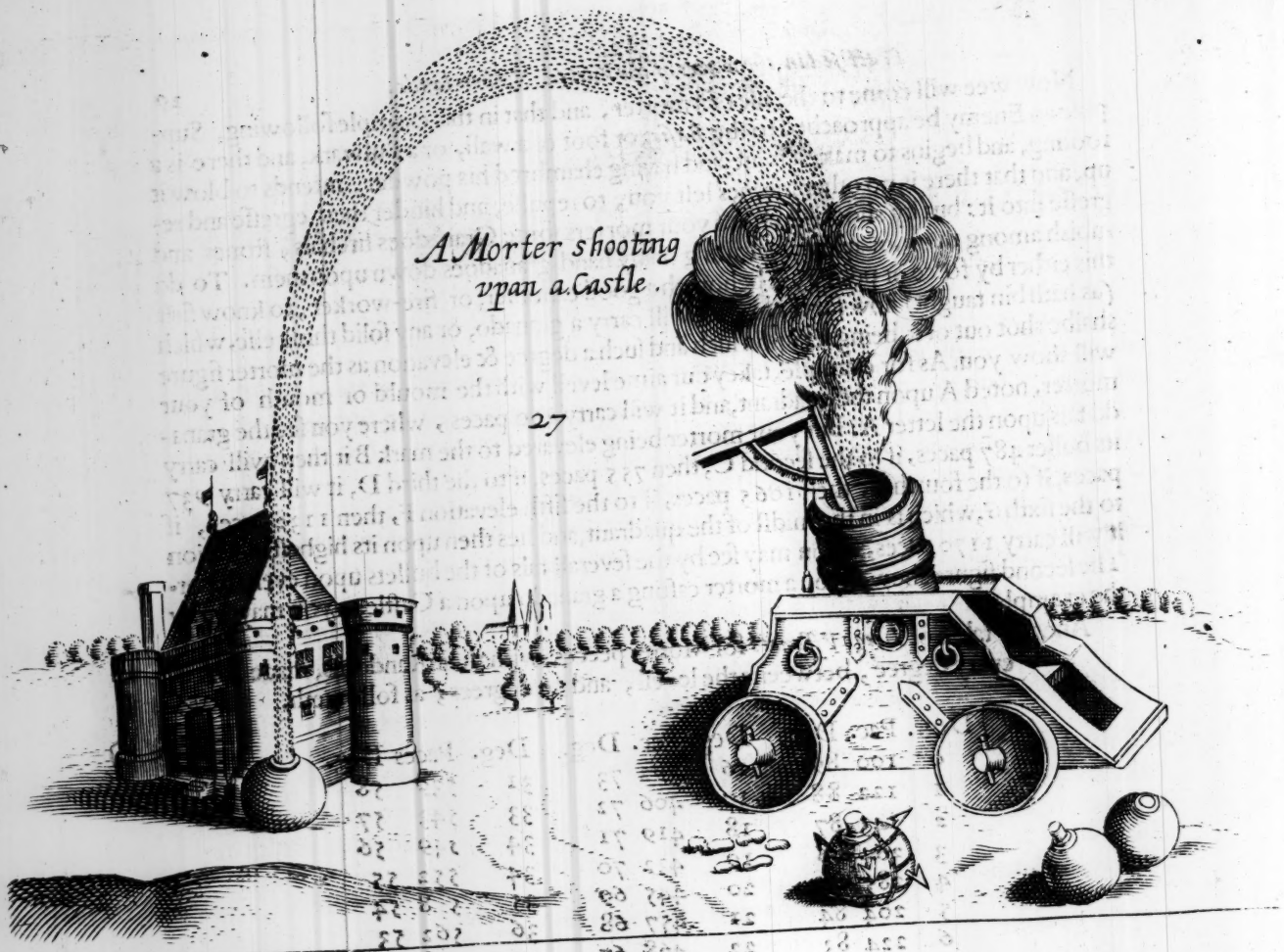
Now then having reſolved of the premiſſes, touching your peece, ſhot, and powder, as aboue ſaid, and upon the diſtance and monture of your mark, as the rules and tables following ſhall direct you, then for the bending and diſpoſing of it to the aſſigned mark, lay firſt a ſtraight ruler upon the mouth of your morter, and upon it place a quadrant (as you may ſee by the figures, or ſome other inſtrument croſſe-wiſe, to ſet the morter vpright for ſhuning of wide ſhooting, and then placeing them fore-right to elevate it into the reſolved degree of monture, to avoid ſhort or overſhooting accordingly, as the tables following will teach you, for having made one ſhot, you may thereby, proportion the reſt conſidering whether you are to ſhoot with or againſt the wind, or whether it blowes towards the right or the left hand, whether weakely, or ſtrongly, and ſo accordingly to giue or abate the advantage, or diſadvantage, which iudgment and diſcretion will induce you thereunto, and the helpe of the Rules following.

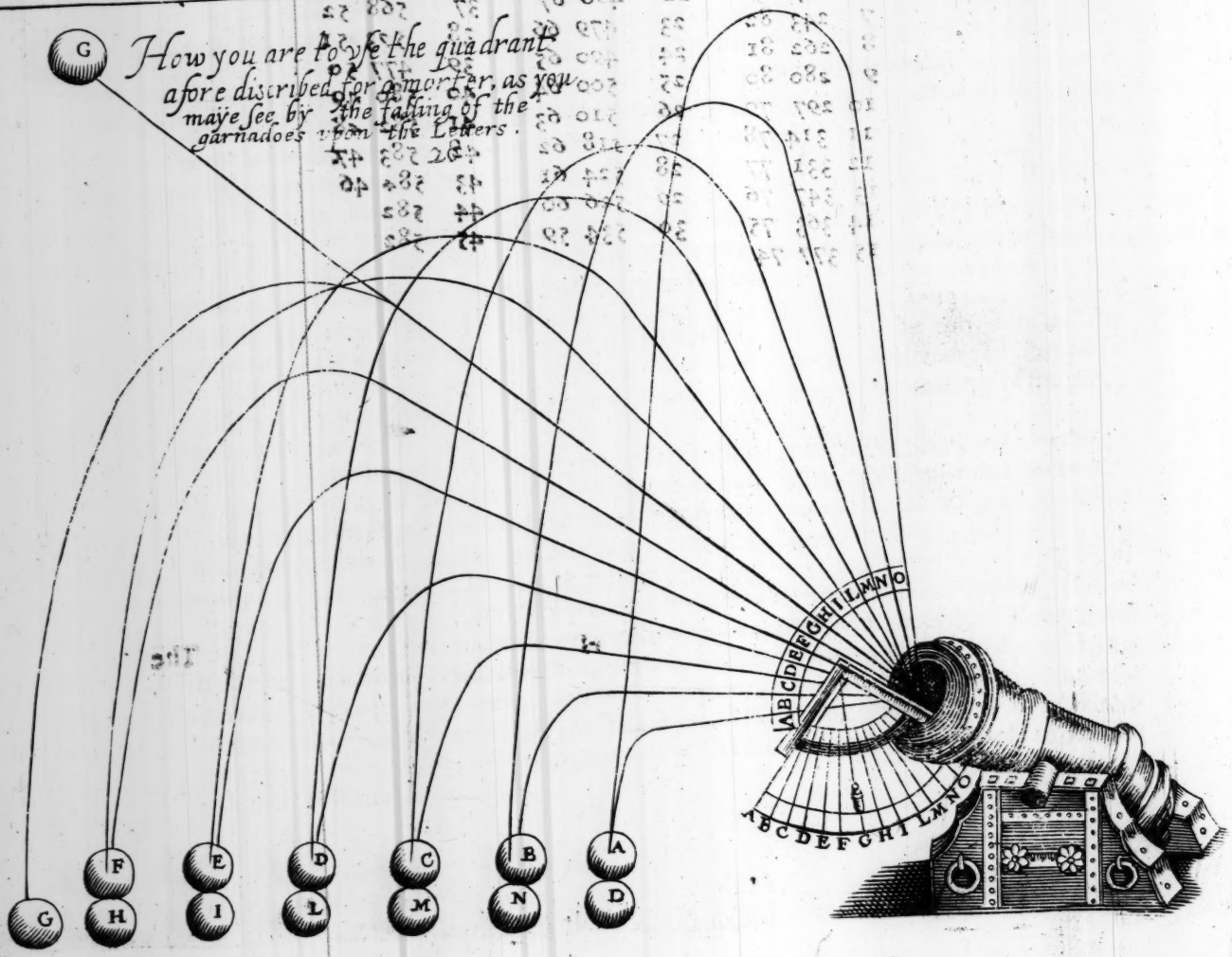
Now

Now wee will come to the uſe of a morter, and that in this example following, Suppoſe an Enemy be approached to the *Baſis*, or foot of a wall, or a Bulwark, and there is a rooting, and begins to make a mine, and having chambred his powder, intends to blow it up, and that there is no other meanes left you, to repulſe, and hinder their egreſſe and regreſſe into it: but by shooting out of your morters ſome Granadoes fire-bals, ſtones and rubish among them, or at leaſt by caſting many hand-granadoes down upon them. To do this either by force or policy, it behoveth a good canonier, or fire-worker, to know firſt (as hath bin taught) how far his morter will carry a granado, or any ſolid thing elſe, which shalbe shot out of it, being ſet upon ſuch and ſuch a degree & elevation as the morter figure will show you. As for example, takey our aime levell with the mould or mouth of your morter, noted A upon the quadrant, and it will carry 200 paces, where you ſee the granado fals upon the letter A. but your morter being elevated to the mark B it then will carry its bullet 487 paces, if to the ſecond C, then 755 paces, if to the third D, it will carry 937 paces, if to the fourth E, then 1065 paces, if to the fifth elevation F, then 1132 paces, if to the ſixth *G*, which is in the midſt of the quadrant, and lies then upon its higheſt elevation it will carry 1170 paces, as you may ſee by the ſeverall fals of the bullets upon every letter. The ſecond figure showes you a morter caſting a granado upon a Caſtle, as you may ſee by the example.

Another table of *Diego Vffanos* for Morter peeces, with their Randoms, made for every degree, betweene the levell, and 90 degrees, as followeth.

Degr.	Pac.	Deg,	Deg.	Pac.	Deg.	Deg.	Paces	Deg.
0	100	89	16	392	73	31	539	58
1	122	88	17	406	72	33	543	57
2	143	87	18	419	71	34	549	56
3	364	86	19	432	70	34	552	55
4	285	85	20	445	69	35	558	54
5	204	84	21	457	68	36	562	53
6	224	83	22	468	67	37	568	52
7	243	82	23	479	66	38	573	51
8	262	81	24	490	65	39	477	50
9	280	80	25	500	64	40	580	49
10	297	79	26	510	63	41	582	48
11	314	78	27	518	62	42	583	47
12	331	77	28	524	61	43	584	46
13	347	76	29	526	60	44	582	
14	363	75	30	534	59	45	582	
15	377	74						


A Morter shooting
vpan a Castle.
27


How you are to vse the quadrant
afore discribed for a morter, as you
maye see by the falling of the
garnadoes from the Letters.
G
F
E
D
C
B
A
G
H
I
L
M
N
D
A B C D E F G H I L M N O
A B C D E F G H I L M N O

TREATING OF COMPOSITIONS, MIXTURES AND INGREDIENCES FOR THE MAKING OF YOVR Concaue, or hollow *GRANADOES*, both great and ſmall, to be shot, or caſt out of a Morter, and alſo of your *HAND-GRANADOES*, to be caſt into a Trench, a Sapp, or the worke of an Enemy.

The Eleventh Chapter.

FIrſt, take three parts of Canon powder well pounded, and ſifted, one third part of Greekiſh pitch, & halfe the weight thereof in brimſtone, mingle theſe two lightly together, and then add to them a half part of ordinary ſalt, and afterwards knead them well together, with oyle of linſeed. This done, fill the pipe of a Cain, with ſome of this paſte, and commixture for a tryall of it: if it carryes the flame cleare and faire, and blowes out of the pipe, with an offenſiue force, without cleaving to the pipe, into which it was put, then without all queſtion it is a ſigne and token of the goodneſſe and perfection thereof.

Now to charge a granado for your Morter or Bombard with this mixture, and ingredience: firſt you muſt take a round ſtick, to turn them about withall, of the bignes that it may go iuſt into the touch-hole of your granado, which you are to charge by reaching down to the very bottome of it, and giue it a ſtamp or two with the ſaid ſtick, continuing ſo, filling and ſtamping it, untill you haue filled up the concaue of your granado up to the touch-hole of it within three or foure fingers breadth, then put into the pipe, or hole of your granado, an artificiall match, and fill it up round about the match, with the aforeſaid Ingrediences even up to the very top of it, which you may do with your finger, without the help of the ſtick, becauſe the match will ſtand bolt upright in the hole, and in the very midſt of it. Laſtly take a peece of courſe linnen cloath and ſmeare it over with pitch and waxe well melted together, and lay it ouer the mouth of your touch-hole, in ſuch ſort, that the upper end of your match may peepe up a little through a ſmall hole, made in your cloth, and then you muſt bind it hard about, by making your cloth faſt to the mouth of the Morter.

There are divers other receits, both for the making of your Compoſitions, for great and ſmall Granadoes, much differing one from the other, but of all others, this aboue is of excellent vſe, and therefore it is needleſſe for me to ſpend more time in the further ſearch and diſcription of them: onely remember this for a generall rule, that in all compoſitions, mixtures, and ingrediences, they muſt all be well dryed, pounſed, and pulverized, but for your great morters, it will ſuffice if they be lightly broken, the fall, breaking, and operation of them, are able to teare, rend, and breake downe houſes in peeces. The figures of the granadoes are marked A B C vnder the Morter figure.

The ſame ingrediences will ſerue alſo for your hand-granadoes, if they be finely dryed, pounced and pulverized as is aboue-ſaid, and thus much for your Bombards Morters and granadoes both great and ſmall.

TREATING OF A PETTARD, WHICH IS A KIND OF A short peece of Ordnance, deuiſed of late yeares, for the blowing open of Gates, Ports and breaking down of draw-bridges. Their making, uſe, and manner of charging are here diſcribed.

The eleventh Chapter.

THE Modell or forme of a pettard, repreſented unto you in the next plate and figure, is not much unlike to a Grocers, or an Apothecaries Spice-morter, and ſome are tapred much like a Coopers payle, little deeper then the Dyamiter of their mouthes but being not aboue ¼ in dyamitre at their bottome, or breech of their mouthes calibre, and in thickneſſe of mettell ⅛ of the Dyamitre at their breech, and leſſening by degrees in thicknes towards their mouthes, Their magnitudes are ſome to hold but one pound of powder, or leſſe, and others to hold 50 pound or more, and they vſually allow foure pound of braſſe, or fiue pound of yron, to caſt a pettard for one pound of powder, and two hundred 50 pound of braſſe, or 3 hundred pound for a pettard that ſhall hold fifty pound of powder, uſing thoſe proportions diminished for leſſer, and augmented for greater, as Mr Norton in his practize of Artillery deſcribeth.

The demonſtration thereof out of Diego Vffano.

Being maſſie and heavie (whereof the figure A is the mouth, B the breech neere the touch-hole) it muſt be carried upon a thick-board or planck, marked E F, and then layd upon a Karr noted C D, which ſerues not only for the uſe of it, but alſo to raiſe it, when you are to hang and faſten it upon a Port. This planchier in the midſt, hath a round hole in it marked H, I through which the noſe, or mouth of your pettard is enchaſed. Aboue it there are two yron rings to hang it on to two Crochets marked G ſcrewed faſt into the port marked A with a match to giue fire unto it. A A are the Bungs, or tampkins wherewith the mouth of the Pettard is bunged up or ſtopped.

The outſide on which the planchier is enchaſed being three inches thicke is even and plaine, armed with ſtrong plates of yron to defend it from ſplitting: it is alſo to be underpropped with the forked reſt, and ſtayed in the ground at the hinder end to keepe it from recoyling.

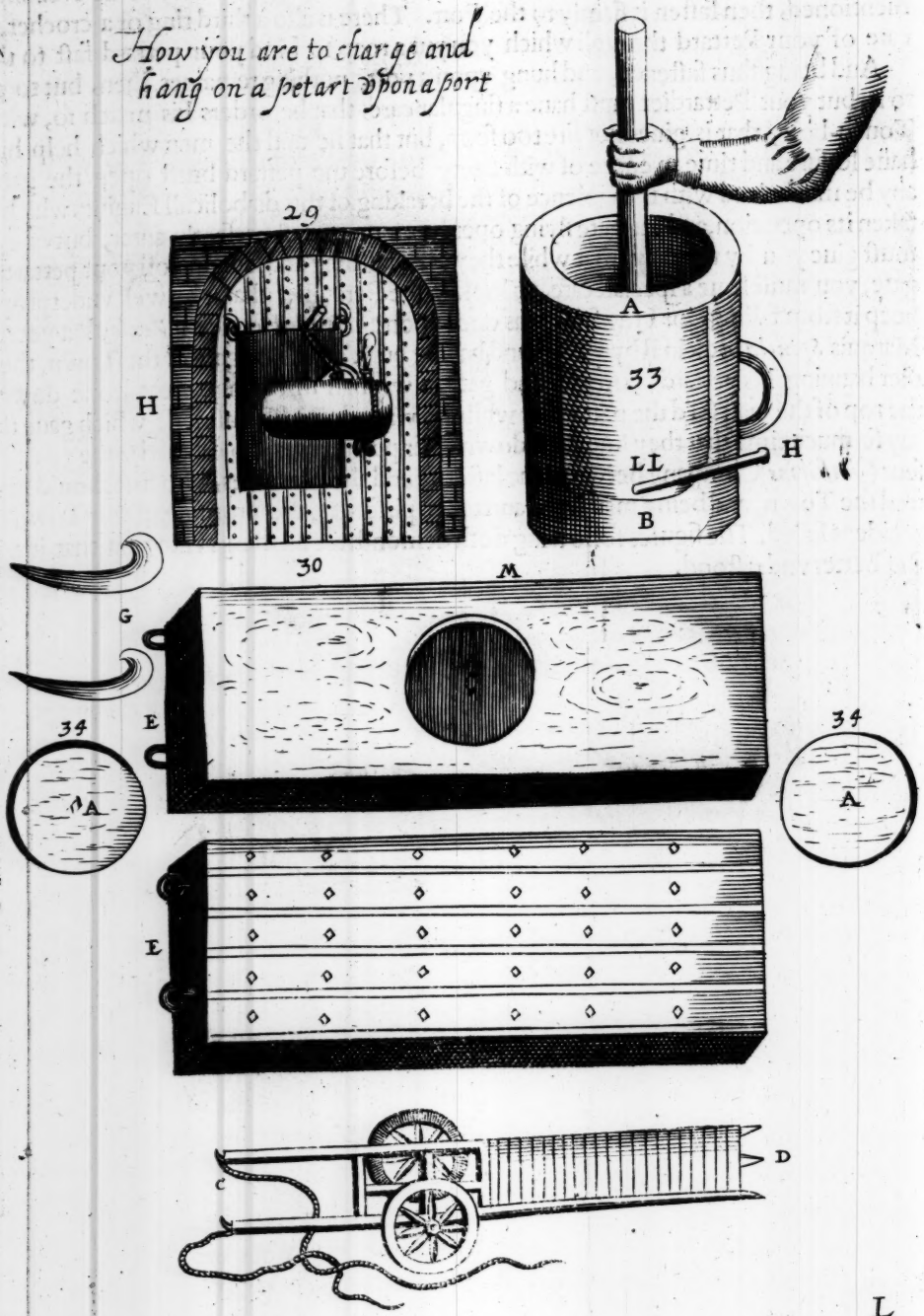
When you charge your pettard, you put a round ſtick into the very midſt of the mouth of it down to the bottome, about the length of halfe a cube and ſome two fingers in circumference, & put no more into it at a time, then the better part of a pound of fine corne powder, and ſo fill it litle and litle, ſtamping it well in, round about the ſaid ſtick, with yron drifts or wodden ſtampers within the concaue of the Pettard, vntill it be filled within one fingers breadth of the top and haue its due charge, then turne your ſtick in the midſt about draw it out gently and fill up the hole out of which you draw the ſticke with fine powder that when you are to giue fire at the touch-hole, the whole charge within may be fired in the twinckling of an eye, And having thus giuen it the full charge, then ſtop the mouth of it cloſſe with the bung or tampkin noted A, which muſt be of the thickneſſe of your litle finger, and laſtly couer the mouth thereof with a thick waxed cloath, and power melted waxe vpon it ſome two fingers thick aboue the tampkin, & thus much for the charging of a pettard.

Now

Now we come to the faſtning and hanging it on a gate, to do this well, you muſt firſt ſcrue in faſt into the Gate the Crochets marked *G.* and make choice as neere as you can of the weakeſt place of the *Gate* or *Port*, where it may eaſilieſt be broken open, upon this hang your *Planchier* and put the mouth of your *Pettard* through the hole of the *Planchier* aboue mentioned, then faſten it firmly to the Port. There is alſo a third ring or a crochet, and the eare of your Pettard through which you put a roap to bind your pettard faſt to the Port.

And being thus faſtened, and hung vpon a port, nothing remaines then, but to give fire to it, but your Pettardier muſt haue a ſingular care, that he orders his match ſo, within the Touch-hole, that is giues not fire too ſoon, but that he and the men which help him may haue leaſure and time to come of with ſafety, before the pettard burſt open the gate, leaſt any be miſcheived with the violence of the breaking of this diabolicall Engine, which hauing taken its operation, and the gate flying open, your men muſt preſently enter, but one caviat I muſt giue you by the way, that while they are a faſtning and hanging on your pettard, to the gate, you muſt haue a ſpeciall care, to look to the Percullies, that it be well vnderpropped to keep it from falling, for I my ſelfe was once vpon a peece of ſervice at *Venlo*, that yeere as the Marquis *Spinola* took in Rhyn-berg, and having burſt open one gate of the Town, the petardier hanging his pettard vpon a ſecond gate, a woman throwing a great ſtone down from the top of the wall fel'd the pettardier while he was a doing his buſineſſe, which gaue the enemy ſo much time that they knocked down their percullis, and ſo catched ſome 30 of Mounſeur *Chaſtilons* Company between the laſt gate and the percullies, who firſt should haue entred the Town, and being maſſacred and taken pirſoners, the ſurpriſing of that Town by this accident failed. The figures following doth demonſtrate all things vnto you that it may be the better vnderſtood.

How you are to charge and hang on a petart vpon a port



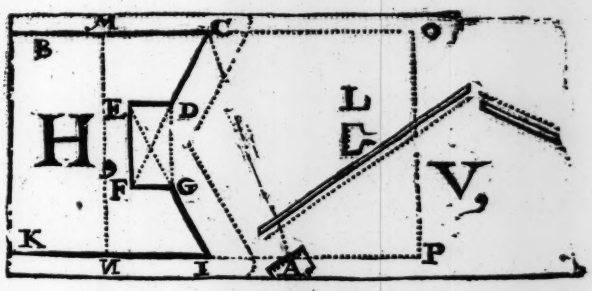
L

A QUESTION PROPOUNDED TO THE BATAVIAN INGINIERS, by Master *John Baptista* Mathematician of ANTWERP, for the Battering of a HORNE-WORKE.

ACCORDING TO THE PROVERB.

Let skill appeare by good demonstration.

And Dissolved and Resolved by that famous Mathematitian, Master JOHN STAMPION of the *HAGH* in HOLLAND.



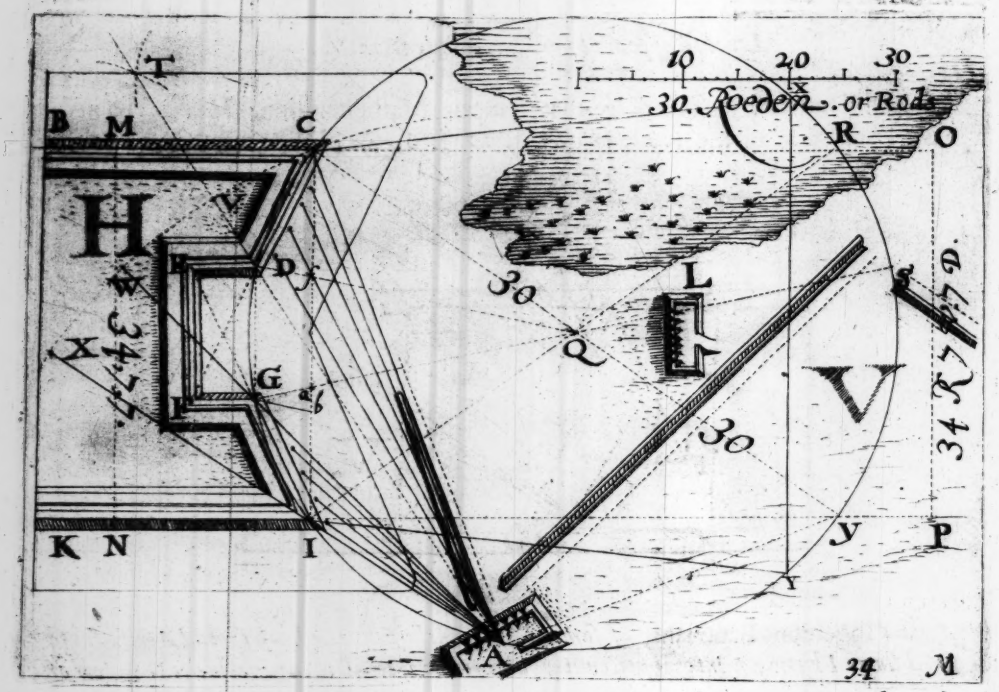
The report (Ingenious Batavians) *of some of your unskilfullnesse, hath spread it selfe farre abroad, and flown I know not into what country, and yet no speciall thing is come to the view of the world, whether out of your own selfe conceit, or from some blast of Superbitie: It is so that I my selfe have thought good to propose this question unto your ingenuity, as a Touchstone, that it may be dissolved, according to the true Touchstone of that noble Science of the Mathematicks by which it may be known.*

THE PROPOSITION IS THIS.

SUppose a Generall having approached to a certain Hornwork which is here decyfered by the Letter *H.* and hath come with his line or fapp near unto the moat of this Horne-work, and there desires to cast up a royall battery in the place noted A. for to flanck upon E. D. and D. C. in such sort, that the force of the Canon may beat aswell upon the Face as upon the Flanck, to wit, *Proportio Equalis*, by an equall proportion. Together that the two wings C. D. and G. I. and the distance G. D. which are all alike to each other, may be flancked with the lines and blowes, yet so, as the distance of the battery A. to the point C. be no more then sixty Rodd or six hundred foot, and the breadth of the Horn-work to be as M. N. or O. P. and being measured, is found to be 34. Rodd, 7. foot, and 4. Inches. The question is how this must be wrought.

Moreover of the same Horn-work the face is as much as the two greatest valuation of 1. *a.* there *a. 1. aaaaaaaa.* 875. *aaaaa.* 3470. *aaaa.* 20640. *aa.* 104040. *a.* are alike to 5. *aa aaaaa.* 1147. *aaaaaa.* 28182. *aaa.* 118800. and the distance *A. C.* no further then 900. foot. *O. A.* and the rest of the conditions as aboveside. The question is to find out the breadth of the Horne-work, and also the other parts as is aboveside.

THE MATHEMATICALL DESSOLUTION UPON THIS Antwerpian Queſtion : Dedicated to all the Lovers of that noble Science, by Maſter *John Stampion de Jonge*, Mathematician.



Sirs. *The wing of fame hath of late fluttered out that now our ingenuity is brought to the tryall of the Touchſtone, by propoſing of a certain Queſtion uuder the name of Senior* John Baptiſta *of* Antwerp, *whoſe pate is ſwoln with ſelfe conceitednesſe and pride, which being not worth the anſwering, I will come to the ſolution of it, rather to give ſatisfaction to our* Batavians, *then to fulfill the deſire of the Propounder: And this may ſerve as an introduction unto it,* to the end, *that the honour which he doth aſſume unto himſelf, may not wholy be appropriated to him.*

THE DESSOLVTION.

LET this figure above of a Horn-work (as hee ſaith) be decyfered by H. whoſe breadth M. N. is known to be 34. Rodds, 7. foot, and 7. inches, and the required battered noted A. whoſe place is likewiſe found out by the known conditions. The firſt condition is, that the violence of the Canon planted upon the battery A. beates with as much force upon the flanck E. D. as it doth upon the Face C. D. whence it is manifeſt, that the Angle of the *eſpaule* or shoulder E D C. being devided into two equall parts with the right line T. V. D. A. that then this battery of neceſſity muſt come to be in the right line T. D A. Secondly, that the face D. C. and I. G. and the diſtance D. G. may with the like Canon shot be flancked and beaten upon by the battery A. that is, when as the Angles I. A. G. G. A D. D. A. C. are alike one to the other, whence will follow, that through the five points, C. D. G. I and A. a circular circumference will paſſe. Now for that which concernes the third known part, namely, as that the batterie A. muſt be no further from C. then ſixty rodd, or ſix hundred foot, A. being the greateſt diſtance in the circumference as is in the third booke and fifteenth propoſition which is taken from of the middle-line of Euclids propoſitions, we have found out according

ding to this preparation, the middle line as *C. Y.* to be ſixty rodds, the right line *C. I.* to be nine 34. rodds, 7. foot, and 7. inches, or 34. $\frac{77}{88}$ and the lines *I. G. G. D.* and *D. C.* to be anſwerable one to another. Let G. now be the Center, Then ſubſtract I. G. and Q. D. cutting through C. I. in A. and F. then will I. A. or I. C. be alike to one of the lines, I. G. &c. becauſe now Q. I. ſtands alike to I. G. as I. G. is alike to G. A. and by the fourth propoſition of the ſixt book, as Q. A. is alike to A. F. ſo alſo Q. G. is to G. D. or as I. G. is to G. *A.* the cube upon I. G. with the corps which is made upon the quadrate I. Q. as ſuperficies, and the depth I. C. are together alike to the corps upon the Quadrate I. Q. as ſuperficies, and the depth to be three times the length of I. G. whence will follow, alwell by the corporall cutting of a dye, as we have shown in our New Algebra which shall shortly God willing come out in English, as by Sectione Com. by which I. G. is found to make 28. $\frac{1}{2} - \sqrt{263}\cdot\frac{1}{4}$ ſo doth E. F. or D. C. likewiſe, and laſtly the Angle E. D. C. being devided into two equall parts by the precedent T. D. then you have the cutting of A. in the circumference out of Q. where your battery is to be caſt up.

Now whereas Mr Stampion hath not expreſſed the finding out of the face G. I. by reaſon of the little ſpace contained therein, the more becauſe he hath fully shown the Diſſolution thereof in his new Algebra, we will here demonſtrate the whole working thereof, how the face G. J. by his new Algebra annexed hereunto is to be found out.

The operation.

Setting down for G. I. x. ſo comes xxx + 31293 alike to 2700. x. or xxx—2700. x like to — 31293. which is an equality in the third caſe of the Algebra of Mr. *John Stampion*, which being changed by the ſecond caſe comes to be xxx—2700 x. as 3129. is alike, out of this vacant number 31293. is extracted a Cubice-root, 2700. times, the ſide as Mr. *Stampion* teacheth in his new Algebra, pag. 112. and 113. comes the valuation of x 57. whereof the whole working shall here be ſet down as followeth.

The finding out of the firſt Letter.

5. 5. 25. 5. 125.

2700. 5. 13500.

13500.
—1000. The firſt Subſtraction.

The finding out of the second letter.

	5	25	
	3	3	
	15	75	
		2700	
343	49	4800.	
		7. The second letter.	
	135.	33600,	
	60.	735.	
	705.	41343	
		~~41293~~ the last Substraction.	

~~4~~193 (7
~~4~~800.

The devider.

This 57. is now the valuation of x as xxx 2700. x is like to 31293. for the same value the signe—set down commeth 57, for the least valuation of the equality then in xxx—2700 x is alike to 31293. Now to find out by this 57. the length of the face, G. I. as followeth in the Rule fol. 138. of his new Algebra, that is, taking the half of 57. which is 28. $\frac{1}{2}$ and multiply the same quadrate, and the product will be 812 $\frac{1}{4}$. whose tripple is 2436 $\frac{3}{4}$. and being substracted out of 2700. the number x. remaines 263 $\frac{3}{4}$ whose square root is $\sqrt{}$. 263. and being deducted from the half of 57. as being 28 $\frac{1}{2}$ there remaines 28$\frac{1}{2}$. —$\sqrt{}$263. for the length of the face G. I. and E. F. and D. C. doth as much also.

Observe the manner of the Operation.

47.	2700.
$\frac{1}{2}$) 28$\frac{1}{2}$.	2336.
28.	263.
224$\frac{1}{2}$.	
56.	
28.	
812$\frac{1}{4}$.	
3.	
2436$\frac{3}{4}$.	comes to be 28,—263. for G.I.

CHAPTER IX.

Generall. HAving brought your Approches neere unto a Towne or a Fortteſſe, whether would you chooſe a Bulwarke or a Curtaine to be battered with your Ordnance?

Captaine A. Towne may be aſſaulted in divers places, ſometimes you aſſault one ſide, when as you make your Batterie on an other, Sometimes you chooſe a Bulwarke, otherwhiles a Curtaine to be battered, with this intention, to take in the Towne, aſſoone as poſſible may bee. As for mee, if I were to take in a great Towne which is populous, I had rather chooſe to batter a Curtaine, then a Bulwarke, which hath a high catt, or mount upon it: eſpecially, ſeeing that in great Townes the Bulwarkes lying one far from an other, they doe show the skirt of the Curtaine very open.

Gen. Why would you rather chooſe a Curtain then a Bulwark?

Capt. Becauſe your Bulwarks are alwaies ſtronger and better fortified then your Curtain, and being as it is the principall ſtrength of a place, and better furniſhed with platformes, flancks, &c. will require more time, labour, and charge to batter then your Curtaine.

Gen. But what Generall is ſo ill experienced, as to labour to batter a Curtaine, having two ſtrong Bulwarkes on both ſides of him, to flanker him when hee is to put over his Gallerie, and to giue an aſſault upon the Curtaine: peradventure for his labour and paines, hee may bee well beaten.

Capt. Soft (Good Sir,) Suppoſe that after a great deale of labour and paines you haue battered a Bulwarke, and falling up to the breach to aſſault it, you finde it cut off, and an Enemy lodged in it, muſt you not then beginne to ſap forward againe, to make a new batterie, whereas on a Curtaine there is not that meanes of cutting it off, as upon a large Bulwarke.

Gen. Haue you ever ſeene the experience of it?

Capt. Yes Sir, the Prince of Orange tooke in the Boſch by a Bulwark, and alſo Breda, but Maſtricht was taken in by making a breach, and ſpringing of a mine, upon the Curtain between Jonger Port and a bulwark, howſoever the Town of *Cortes* upon the frontiers of France, was firſt battered by the *Arch-duke of Auſtria* upon the point of a Bulwark, neer unto the very ioynt of the Curtain, where a high, and a ſtrong turret ſtood, which did annoy us much, ſo that we could not advance forward, but were conſtrayned to leaue off our approach on that ſide, and began to make a new Batterie for a breach in a Curtain on the Field-ſide, where there lay a ſtrong Bulwark to defend it, which did our men a great deal of harm, but wohſoever with great difficulty and much adoe, we took in the Town that way, by lodging our ſelues in the Curtain: Likewiſe the city of *Cambray* was battered, and taken in upon a Curtain, for all there were two ſtrong Bulwarks that flanked it, which if we had run our line upon a Bulwark, we ſhould not haue forced it ſo ſoon, yea ſuch an occaſion might preſent it ſelf, that a Generall may be forced to batter both the one and the other, or to find out ſome ſecret way by undermining a wall, and blowing it up with powder.

Gen. This is for your great Townes, but what ſay you to a Caſtle, a Cattadel, or ſome narrow Fortreſſe, how will you goe to worke to take in thoſe with the beſt advantage.

Capt. As for your Forts, and Caſtles, it is much better to batter them upon a mount or a Bulwark, then upon a Curtain: my reaſon is this, that in theſe your Bulwarks lying cloſe one by an other, will flank one an other with the greater force, and hide the Curtain much better to defend it, ſo that one cannot ſo eaſily force it, if the ſaid defences be not taken away.

Gen. Go to then; a Town then being to be battered, either upon a Curtain or a Bulwark how many peeces of Ordnance would you haue to do it, and how, and in what manner would you place, and plant your Ordnance upon your batteries to make a good breach?

Capt To effect this, I would haue 18. peeces of canon and halfe canon, *(for leſſer peeces for batterie are novv grovvne out of uſe)*.

Gen. Whether would you chooſe more whole canon or halfe canon?

Capt. To batter a place well either upon an ſtony or a earthy wall, you may aſſure your ſelf,

the more whole canon you haue, the greater and the moresuffici ent your breach will be: for your great battering peeces doe spoile, and beate downe any thing, which doth meete with their great force and violence: *howsoever of late yeares, experience hath taught at divers seiges that your halfe Canon vvhich a re more port able, having good store of them, vvill doe the businesse asvvell as your vvhole canon.*

Gen. But at what distance would you make your batteries, for these 18. peece. of Canons and how neere unto the place, which you intend to batter.

Capt. I would counsell a Generall to approach as neere unto that place as possible may bee, and make his batteries some two or three hundred paces one from an other, and that if it were possible to advance covertly the Approch and sap, even up to the Counter-scharfe, and very brinke of the moate, to prepare a way for his Gallerie: not onely to batter that place being at hand with the greater force, but also to keepe in, and hinder an Enemie from Sallying out upon the beseigers, to discover and dismount their Ordnance in *Casemates*, or if they haue sunke any in their walles or False-bray, and so to terrifie them, that they dare not stirre out.

Gen. I am also of your opinion, and hold it for good, yet I feare this will not be so soon done, and is sooner spoken, then executed, and that before you can bring your approach and sapp so far it will cost you warme blood, and a great many mens liues, if you haue a stout Enemie within to deale withall, and one that is very Vigilant, and carefull to stand upon his Guard, and his defence.

Capt. T'is true, this cannot bee done without danger, and the losse of men, but hee that is fearefull must stay at home, and not come into the warres where there is neither place nor time, which doth free or exempt him from danger: yet the danger is not alwaies so great, especially in such places, where you haue Earth enough to worke with, to cast up your sapps, and to heighthen and deepen your Approaches, which will show you the more higher you finde the ground in Approching to the edge of the moate, the deeper trenches you may make and cover your selfe by casting up of blinds continually, to keepe you from the sight of the besieged, and it is better when you haue brought your approach as it were under them, then if you were 200. or 300. paces distant from them.

Gene. I pray you Good Sir, how would you plant, and devide these 18. peeces of Canon?

Capt. I would make a great batterie with 8. of them to beate upon a right line, either upon a Curtaine or the point of a Bulwarke (which the Generall shall finde fittest) Two batteries with each 3. Canon to play slope-wise from the great batterie as the ninth plate and 28. and 29. figures showes, and two batteries, with two halfe Canon a peece to play as it were cross-wise upon the breach, and thus you see your 18. peeees planted upon 5. bateries, as you may obserue in the ninth plate and the two figures of a Curtaine and of a Bulwarke following.

Gen. Good Sir tell mee I pray you how many shot will these 18. peeces of Canon make in 10. howers, and how much powder will they require.

Capt. In 10. howres they may make some 1500. shott, and will require a matter of 25000. pound weight of powder, that is 150. barrels full, each barrell contayning 160. pound weight in it.

Gen. You make your account then that every peece in the space of 10. howers is to shoot 80. shot, that is 8. shot an hower for every peece.

Capt. You may make 10 shot in an howre if you please, if your peeces be renforced, but as for your ordinary peeces, they haue not mettailline substance enough to beare it: considering also that after you haue made 40. shot out of a peece, it will be so heated, that it must haue a cooling time, which must bee at least an hower, for otherwise your peece being growne over hot, it may cause danger.

Gen. Me thinkes that 80. shot for a peece in so long a time were too little, having often heard, that in that while, a peece may well be shot of 130. times, can you giue me your resolution upon this?

Capt. I will tell you Sir what hapned once in the Iland of *Bomble* Anno 1599. we planted a peece by a mill, by which we did annoy the Enemy very much, so that they were forced to

make

make a battery, and planted a whole Canon and a demy-canon upon it, ſeeking to diſmount ours. Now shooting with this peece from foure of the clock in the morning, till eleven toward noone, this peece had a cooling time the ſpace of two howers, and about one of the clock, wee began to play with it againe, and continued shooting with it till 4. a clock in the afternoon: but this peece being not able to endure the force and heating of ſo many shot, we were conſtrain'd to leaue off with it and yet ceaſed not shooting with our other peeces from an other batterie by command from *Don Lewes de Valaſco* Generall of our Ordnance, and shooting croſwiſe with ſome other of our peeces, wee put the Enemies two peeces to ſilence in the ſpace of an hower, a Souldier of ours ſtanding by, was curious to keepe a taily of the number of all the shot we made from the morning till foure a clock in the afternoone, and showed mee 80. notches, which deducting the two howers cooling, our peece planted at the mill made 8 shot in an hower, which was as much as could be required of it.

Senior Diego Vffano *giue your Tranſlatour leaue to interrupt you a little, and ſo to conclude this diſcourſe. Iffyou remember at the ſeige of Oſtend which you mention often in your Chapters and dialogues you were without, and I was within the Towne, that on the ſeventh of January Anno* 1602. *Stilo Novo, After Sir* Francis Vere *of famous memory (who defended and kept the Towne againſt you) had deluded you with a* Parley, *onely to gaine time, and to make up our Canon and Sea-beaten workes, along the skirt of the old Towne, his highneſſe the Archduke reſolved to aſſault us, and that morning began to batter* Sand-hill *and* Schotenburgh, *to make a breach for you againſt that night, with intent to Aſſault us (as you did) and to haue entred the Towne, and haue put us all to the ſword, the Relation whereof you ſhall heare in the end of this booke. Now you had placed and planted your* 20. *peeces of Canon to batter them in this manner,* 8. *from your batterie at the foote of the* downes, 8. *from a batterie on the right hand of the downes,* 6. *more which you had made upon the ſand, and as it were raiſed out of the ſea: the firſt shot upon the breach in a right line, and the other* 2. *ſlopewiſe, as your two figures following doe demonſtrate. Theſe* 20. *peeces of Canon towards noone had a cooling time, for a matter of ſome* 2. *howers, juſt as you haue ſaid, and afterward you began to batter the breach and old Towne againe, till it was almoſt twilight, and then they cooled againe, till you were readie to giue us an aſſault, and before you fell on as I doe well remember, you shot of one of your Canons with a hollow bullet which flew over the Towne and made a great humming noiſe as a warning peece to the* Count of Bucquoy, *who lay on the Eaſt ſide, that you were then ready to fall on, and that he ſhould doe the like, this was your Signall: Now* Generall Vere *knowing well your intent, gaue order to the Gentleman of our Ordnance who had the guard upon* Sandhill, *that hee ſhould keepe a true* taily, *and an account of all the shot you made that day with your* 20. *peeces of Canon upon the breach and the old Towne which being caſt up, there were found to be made that day from morning till night* 2200. *shot, which was found to be an* 110. *shot for every peece, and* 11 *shot an houre for every peece, which is more then* 8. *but I verely beleeue your peeces were renforced.* This by the way, and ſo I returne againe to your owne dialogue.

Gen. (Good Sir) I pray you show mee how you would batter the point of a Bulwarke (as the figure 28. following demonſtrates,) and giue mee ſome reaſons aſwell defenſiue as offenſiue.

Capt. I am willing to giue your Lordship content, and ſay, If I were to batter the point of a *Bulwarke* or a *Baſtion*, I would haue the ſame number of battering Canon, and planted in the ſame forme and manner as they were for the Curtaine and to shoot sloope and croſſwiſe alſo, and if your approaches were advanced ſo farre they should be planted upon the very brinke of the moate and upon the *Counterſcharfe*, I would plant 4. of them ſo, that they should diſmount the Enemies Canon in their *Caſemates*, or any if they had ſunk them in their *Falſebray* which should waite vpon that occaſion.

Gen. I am of your mind and preferre ſuch a battery before all others who are of the opinion that they had rather chooſe a Curtaine then a Bulwarke to be battered.

Capt. You haue heard my reaſons for that, and ſee the figures following traced out to you. But as for your *Bulwark* the *beſieged* may cut it off (as you may mark in the figurs of *retrenchments* and *Cuttings off* in the ſecond part of this booke) for indeed it will be a hard matter to force an Enemy out of a Bulwark, who is reſolved to looſe it by peecemeale and

degrees and there is not ſo much danger in aſſaulting of a Curtaine, which being once well battered and beaten down with your Ordnance, you have an eaſier way and entrance to fall on with your troupes of men, to enter the Towne or Fortreſſe,but for the defence which is made from your flanking Bulwarks, or your Caſemates, you muſt make batteries upon the brinke of the moate againſt them,(as is ſaid) to diſmount the Enemies peeces,and to flanker with your Ordnance the parapets of the Bulwarkes to beate them about their eares, that the bulwarks may lie the more open to you, and I think this way is the leaſt danger.

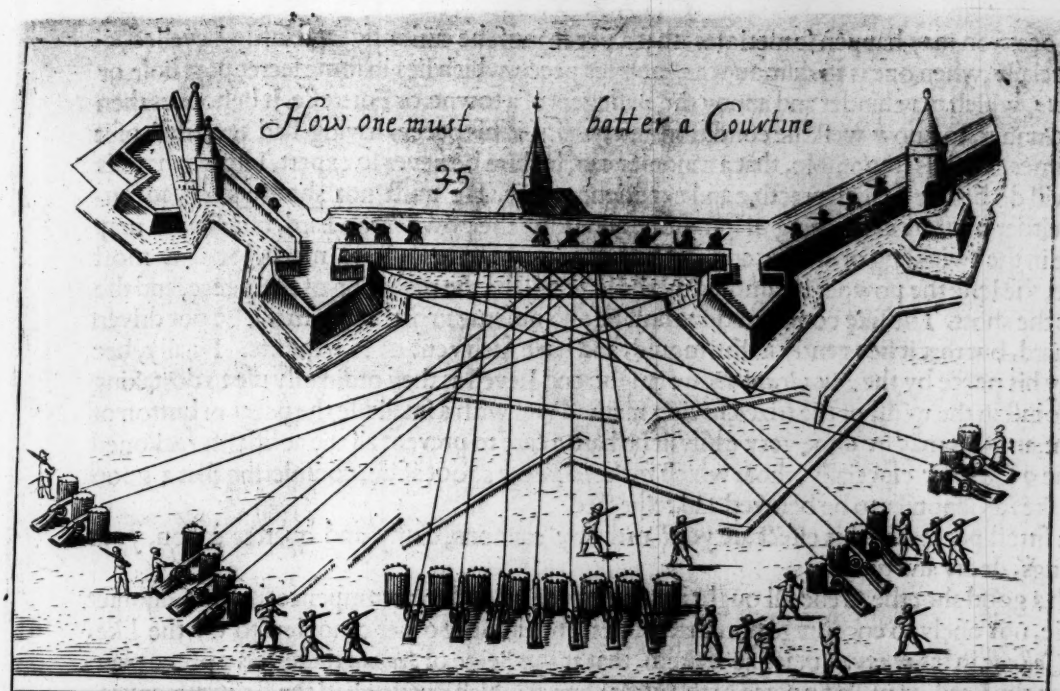
Gen. But the beſieged their cuttings off, may they not be made aſwell upon a Curtaine as upon a Bulwark?

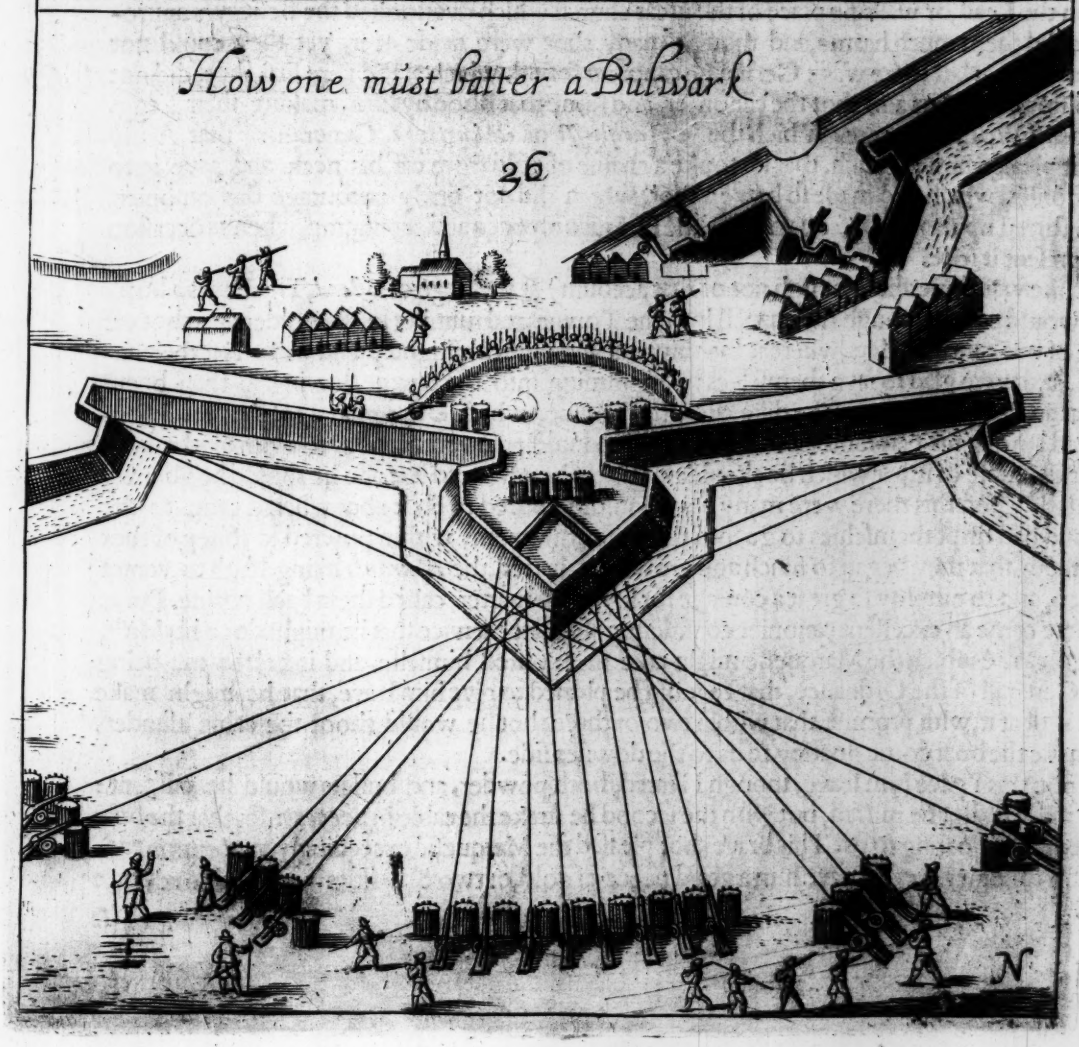
Cap. No, for the Rampier being thinner, you have neither ſo much ground, nor the like accommodation in a Curtain as in a Bulwark,and indeed, a Governour of a town or of a fortreſſe if he were put to his choiſe,had rather to be aſſaulted on a Bulwark (then on a Curtain) by cutting it off into the form of a halfe moone,that he might make a new reſiſtance,and defend it with a leſſe number of men: Beſides,in a Bulwark the beſieged have this advantage over the Aſſailants,which is very dangerous for them,that they may make a mine within the bowels of their Bulwark,when an enemy shall attempt to aſſault it,and thinking to enter the breach,and take the town,they may be blown up into the aire by a countermine, the like alſo may happen to the beſieged,the Aſſaillants ſpringing their mine alſo in a Bulwark,when they think they ſtand upon their beſt defence.

Gen. May not the like be done alſo in a Curtain?

Cap. No,It will not take the like effect as in a Bulwark,for a breach being once made in a Curtaine, for as an enemy may aſſault it at large,ſo they may bring a greater number of men to fight to help to defend it,whereas in a bulwark they are pend up and ſtraighted in a narrow place,which may be cut off,and will require a fewer number of men to defend it, whereas thoſe which are to force it,muſt be conſtrayned to bring up a great many men to aſſault,who in an inſtant may be in danger of blowing up.

Gen. Your reaſons (good Captain) are not to be ſlighted, but as for me, I hold it ſafer to batter and aſſault the breach of a bulwark then of a curtaine. For though the beſieged may cut it off,and defend it with a fewer number of men,yet the Aſſaulters have this advantage over the beſieged defendants,that they have more place and elbow room, and may find a leſſe reſiſtance then in a Curtain,ſeeing that one may make as great a breach in a Bulwarke, as in a Curtain, becauſe your Ordnance may beat it flat and levell with the ground, and chooſing rather a Bulwark: I will herewith conclude this diſcourſe,and now ſhew you the figures both of the one and of the other in this plate following.


How one must batter a Courtine
35


How one must batter a Bulwark
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HOW A CANONIER OUGHT TO GOVERNE himſelfe in makeing of a good shott.

CHAP. X.

AN occaſion may happen ſometimes, that a peece muſt be curiouſly, and iuſtly Levelled, eſpecially, when one is to diſmount an enemies peece, which lies in ſome ſecret port hole or *Caſemate*, which may hinder and annoy the Beſiegers of a towne, or Fortreſſe. It behooves then a good Gunner, to know well the condition and quality of his peece, having had the triall of it many times. For it is impoſſible, that a canonier can, let him be never ſo expert, know what his peece will do before he hath practize and experience of it. He muſt not shoote at all adventures, neither muſt he in charging of it, ramme and ſtopp the powder too hard, but that it may take fire in the twinkling of an eye, and that his peece may not recoyle to much, for it is moſt certaine, the leſſe the powder is rammed in, the leſſe will be the recoyling of the peece, and the eaſier is the shott. The like conſideration muſt he alſo obſerue in his bullet, that it be not driven in too hard, but that it lies gently in the mould, and have ſuch vent as is requiſite. Finally, hee muſt lay his peece by the *Quadrant* aboue taught, and Levell as they ordinarily uſe to do, taking his aime iuſt in the midſt of the frizes, having marked wel with a ſmall file the point or button of the ſight, and this may be done very eaſily, if he hath a care to prevent all the accidents reckoned up in the 9 Chapter eſpecially, thoſe which makes a peece shoot aſide, conſidering that a good shot makes a Canonier to be beloved and reſpected.

The fitteſt peeces for this effect are your ordinary cannons, demy and quarter canon, your culverings, demy and quarter.

Such a good shot the Generall ought to take notice of, and to recompence ſuch a Canonier liberallie, not onely to encourage him that made it, but alſo the other canoniers to do the like. *Lewes Collade* in his *manuell* practize writeth, that at the Seige of *Sienna* there was a peece planted upon the Lead, or walking place of the great church which overlooked the Beſiegers approches and did them much harme, and though many shot were made at it, yet they could not diſmount it, till at laſt there was a Germaine canonier found, which at the very firſt shot, did not onely diſmount it, but alſo shot the canonier, and ſome that ſtood by him, making their Leggs and armes fly vp into the aire. Which the *Marqueſſe* of *Martinia*, Generall of that Army ſeeing, it pleaſed him ſo much, that he tooke a chaine of gold from off his neck, and gave it to this Canonier, which had made ſo brave a shot, which did not onely encourage this canonier, but alſo ſtirred up others thereby to gaine the like recompence and reputation, when as occaſion might preſent it ſelfe.

The like was done alſo (though not of that account) at the ſiege of *Oſtend*, There was a boat, which would come through the chanell into the Towne, and running in, the rudder was shot off by one of our canon bullets, whereat the shippers were much affrighted, and withall let their anker fall, and were glad to ſave themſelves by ſwimming into the towne, leaving ſo their boate riding at an Ankor between the dike and the Towne, which *Marques Spinola* perceiving, enquired among his Captaines if there were ever a ſouldier ſo venturous as to ſwim to the boat and cut the cable of it, for which he should not onely be advanced but alſo he should be liberally rewarded. Vpon this there were many brave ſouldiers offred to do it: but when it came to the push, and had ſtript themſelues to go into the water, the enemy within powred ſo volley of shot upon them, that they began to flinch and grow faint-harted, the *Marquis* being loath to venter his men, and to employ ſo great a courage for ſo ſmall a matter, called them back againe. But at laſt there came an excellent canonier conſidering aſwell the ſervice that he might do to his Matie, as the pleaſure which the Marqueſſe might take in it: offred himſelfe, and intreated me being then Generall of the Ordnance, that I would be pleaſed to give him leave, that he might make ſome shot at it, with promiſe, that within two or three shot he would shoot the cable aſunder, and make the boat come floating to us to the downes ſide.

Vpon this I gave him leave, though I feared, both powder, and bullets would be miſpent: with the firſt shot he miſſed, but with the ſecond he ſtrake the cable in peeces: ſo that the boat indeed came floating to us. This brave shot pleaſed the Marqueſſe exceedingly, and commending this canonier greatly, gave him a good peece of gold, or two & beſides promiſed to advance him.

It is true Senior Diego Uffano, *your tranſlator being then page unto Generall* Francis Vere, *who then commanded within this Towne, was then a ſpectatour of it, and Sir* Francis Vere *and divers Officers which looked on, commended alſo your Canonier highly, for making ſo brave a ſhot, but I will put you in mind of two or three other, more famous then that. If you remember, there lay a whole Canon of ours upon the Weſt Bulwarke, which carried a bullet of 48. or 49 pound weight, and as it was a brave peece, ſo had it an excellent Canonier, one* Francis Nelſon *an* Engliſhman, *who ſerved Queen* Elizabeth, *of ever bleſſed Memory, in the* Brill, *he ſhooting ſo ſure with it, that he diſmounted 2. or 3. of your peeces which were planted vpon your high Catt upon the Downes, for a revenge you did make a battery of 2. or 3. Canon to diſmount our peece, and one of your Canoniers made ſo good a ſhot, that he ſhot his bullet juſt into the very bore or mouth of our Canon, ours being charged, your bullet and ours ſtriking together in our Canon. from that violent blow flew ſparkes which gave fire to ſome looſe cornes of powder which were not well driven home, and ſo our peece giving fire to it ſelfe, ſent you backe your owne bullet, and ours to accompany it, without breaking or doing any harme to our peece, and this is moſt true, for there are ſome Officers yet living that ſaw it.*

The ſecond was this, you had a halfe Canon that indevoured to diſmount one of ours, which alſo ſought to diſmount yours, both Canoniers having levelled their peeces as right as poſſibly they could, and giving fire at an inſtant together. your bullet and ours meeting one another in the aire, with the violence of that encounter, both bullets breaking, the peeces of them flew up as high into the Aire as Pauls *ſteeple, if* Vandermyle *the Controuler of the States Ordnance were alive, he could tell you that this ſtrange ſhot is true, aſwell as I.*

And now you are a diſcourſing, I will truly relate two or three more unto you which came from your Catt, Some of our Run-awaies could tell and show you almoſt in what houſe Generall *Vere* lay in *Oſtend*, and you had a shrewd ſpight at him, for ſome dayes you have shot eight or nine Canon shot through the upper part of his lodging, and one night amongſt the reſt, having bin the round, for he was very vigilant and careful to look to your proceedings, and by all means poſſible to hinder your approaches, comming home after Sun riſing, when he knew there was no danger, he went to take his reſt for 3. or 4. houres, and lay downe and ſlept upon his bed in an upper chamber, awaking he called for a clean shirt, and while his footman was ayring of it before a Charcoale fire in the Chimney, while one that was then his Page was a pulling a ſilke quilted waſ-coate over his eares, and calling for the shirt to put it over his head, his footman comming with it, juſt came a Canon bullet of nine and forty pound weight, through a wineſcot bedſtead juſt by Sir *Francis Vere* and his Page, the Lacquey comming with the shirt, shot both his bowels and the shirt to pash, which bloud light and ſprang on him and his page: Was not this a narrow eſcape?

After this Sir Francis Vere would lye no more in this upper chamber, but removed his owne lodging to another lower Roome, howſoever from your high Catt or Mount you could finde us out againe. For a while after, Sir Francis Vere going every night the Round, and viſiting the Guards without the Town, to diſcover how you did advance your approaches, and to make you buy that ground full dearly, The Sunne being up came home to take his wonted reſt, till ten a clock before noone, making our nights the dayes, and part of the day our night, for a reſting time The ſame page after Sir Francis Vere had called for him, came into his chamber, and having a little firkin ſtanding by the hearth, in taking up a few Charcoale ashes into it, comes an other Bullet of ſome 48 pound weight from your Catt, shootes through the utmoſt part of the chimney, a little above the mantle tree, and the bullet having come through a good part of the forehouſe, and being ſomewhat deaded, fals juſt by the pages eares, into the very firkin, which the page was a putting the ashes into, brake it, and made a dint upon the hearth, all the ashes flying out, the page giving a leape towards his Maſters bed, for we could ſcarce ſee one another, becauſe the ashes made ſuch a duſt, and preſently fell downe above twenty great brick-bats, which the bullet had looſened in the chimney (had he not leapt away) upon his head, this was an other eſcape, but for a revenge the page got one of Sir *Francis Veres* centinels, that ſtood in the ſtreete before his dore, to crue up this bullet in a wheel-barrow up to the weſt bulwarke, to the English Canonier before mentioned, and becauſe you write in your former Dialogue, that one bullet may fitt the Calibre or bore of another peece, this bullet fitted ſo juſtly our Canon above mentioned to a

a haire, which was ſent going to you again, piping hot out of our Canon to your Catt: and he made ſo good a shot, that I verily beleeve, he ſent ſome of you to Purgatory, for we could diſcover ſome Armes and Legges which flew up into the Aire, and ſo you were paid with your owne coine.

One or two more, and then I have done, You may remember the ſeventh of Ianuary, that day which you did batter *Sandhill*, and the skirt of the old Town afore mentioned, for all your often shooting, yet there was one halfe Canon lay upon it, not farre from your breach undiſmounted. The ſame page, after he had taken his Levell, gave fire upon two Horſes and a Waggon which came riding along the ſtrand from *Albertus Sconce*, towards your *Pile Battery*, it ſeemes laden with powder or bullets, he made ſo direct a shot, that he ſtrook his mark, killed one of your horſes, and the Waggon shot a peeces. The page being overjoyed with this shot, he would needes make an other, and whiles he was a levelling his peece at an other marke, one of your Canoniers turnes a peece aſide from the Pile Batterie, and shoots juſt in at the very port-hole of our halfe Canon, and came ſo right, that it licked off a pound or two of the mettle of the Muzzle upon the upper Frizes of our halfe Canon, ſome peeces of this mettle killed a Gentleman that ſtood by as a ſpectatour, and shot Sir *John Ogles* Cooke into his belly, which was there likewiſe, but the page which ſtood behind the brich, a levelling the peece with his thumbe, eſcaped, and had no harme, but your bullet flying by his eare made ſuch a humming noiſe in his head, that he thought there had been a ſwarme of Bees in it. This I have written, not for any Oſtentation, but onely to shew you how miraculouſly (yea even in the greateſt dangers) God can preſerve his ſervants, according to his promiſe: Pſal. 90. verſe 7. *A thouſand ſhall fall at thy ſide, and ten thouſand at thy right hand, yet it ſhall not come nigh thee.*

One more, and then I will end my digreſſion: at the laſt ſeige of the *Boſch* the yeere we took it in, *Anno* 1629. We having advanced our approaches cloſe under your little *Skonce*, a musketteir of ours, putting the noſe of his Musket through the Musket baskets to give fire, one of your Firelocks lying upon the ſnap for him, gave fire upon him iuſt at the very ſame inſtant, and shot his firelock bullet right into the very mouth or boore of his musket, ſo that the bullet ſtriking againſt the ſcrue of his brich, bruſt open the *touch-hole* of his musket, and a peece of the bullet came out of the ſaid *touch-hole*, while the Prince of *Orange*, Sir *Horace Vere*, Colonell Generall of the English, and diverſe other Officers ſtood by, and thus you ſee how wonderfully it pleaſed God ſometimes to preſerue his creature.

Now I come to you againe, where you exhort all *Maſter-Gunners*, and *Canoniers*, that will ſtudie this Art, that they with great care and diligence practiſe theſe rules abouesaid, for the levelling, ayming, and taking their markes right, remembring, that there is more dexterity, and cunning to be showne in shooting at a ship, ſayling away ſwiftly before the winde then at a Troupe of Horſe, or Men marching ſoftly upon the Land, or to diſmount a peece planted upon a Tower or a Bulwarke, where you haue an immoveable marke, eſpecially when as you are to shoot upward.

This Art muſt be learned and practiſed, when you haue not much to doe, that when neceſſity cals for your employment, you may then not onely be able to doe your Prince and Countrey ſervice againſt their Enemies, but alſo gain your ſelfe fame and reputarion.

Now hauing treated at large in the former Chapter, how you shall *levell* your peece *point blanck*, *levell with the mettle* or at a *range*; according to the elavation you giue it, To shut vp all, take this obſervation along with you, that if the *muzzle* of your peece, or the button of it be higher then thoſe of the *brich*, then it will carry ouer, Againe, if you take your aime from the *button* reſting onely vpon the thickneſſe of the *Mettaline-ſubſtance*, your bullet will alwaies fall short. But if your *frizes*, be alike, aſwell at the muzzle as at your brich, then you shall be ſure to shoot levell with the mettell of your peece, & shall not faile to ſtrike the marke you shoote at if it lies within the termes of the pointes abou eſaid.

HOW

NOW AND IN WHAT MANNER A GENERALL OF THE Ordnance ought to plant his Canon in a day of Battell, whereby hee may moſt annoy an Enemy.

Extracted out of the ſecond Treatiſe of Don Diego Vffano *his fift Dialogue between the Generall of the Ordnance, and a Captain, as followeth.*

Generall, SIR, I would fain know of you, how Ordnance ought to be placed in a Day of Battell, for to gaule the Enemie moſt ?

Captain, I make no queſtion but your Lordship having had experience in the Wars of *Savoy* and *Hungarie*, can tell better then I am able to ſpeak, and if I ſhould uſe a tedious diſcourſe, it might then ſeem that the Scholler might preſume to teach his Maſter.

Gen. Howſoever, in ſuch a caſe I would willingly take the advice of an old experienced Souldier, and eſpecially of ſuch a one, who hath ſerved in theſe parts. As for me, I dare not boaſt of any great experience, having had enough to do to look unto my owne affaires, neither have I had much leaſure to inform my ſelf well about Artillerie. But now ſeeing I am to receive that charge upon me, I pray you tell me, as a man who hath been beaten thereunto, and hath had long experience in the Warres, how they do uſe to plant Ordnance in theſe quarters.

Capt. Sir, There hath been but a few battels fought in theſe parts, and to ſpeak truly I am not able to ſatisfie you touching this point. Nevertheleſſe, I will tell you what I have ſeen in two, wherein I was preſent. In the one the Ordnance was planted in the head of the Battalions, and in the other between them, two by two, and three by three, upon the flanks and wings of the Musketiers, and blinded with the wings of the Cavallerie. But as for me, I am of the opinion that it is beſt to plant ſome peeces in the front of the Armie, which may play upon the Enemies troopes on all ſides: ſeeking out alwaies for this effect, ſome places of advantage to place them in, that you may not be in danger of looſing your peeces. And though you cannot get ſuch an advantage, yet your peeces being in the head of your Battell, will be of leſſe ſervice, becauſe when you are to come to the Chock and joyning of Battels, they may in ſome wiſe annoy your own men, which I ſaw in one of theſe Battels abovesaid.

Gen. Therefore I think it were fitter they ſhould be placed upon both the flanks, and in the Reere of the Battaillions, by leaving a free place of Armes, which may give no offence to our own men.

Capt. I can hardly beleeve (*Illuſtrious Sir*) that that would be ſo expedient, for an Enemie perceiving that the Front is left bare without Ordnance, he will take the more courage to fall on, and come up to the charge: Therefore, I hold it more fitting, that the Artillerie may be devided ſome here ſome there, both before the Front, and upon the Flanks, placed ſome fifty or an hundred paces one from another, and then there will be no danger when the Enemie ſhall come up to Chock, to encounter you, or offend our own men, eſpecially when they are faſtened to them by drawing-Ropes and yron Rings, that upon an inſtant they may be remooved and turned for the advantage of our own Troops, and give fire as faſt as they can charge and diſcharge among the Enemies Troops, which is a matter of great moment for the obtaining of a Victorie.

But it happens very ſeldome that ſuch convenient places can be found for the planting of Ordnance in a Battell, as were to be wished, for oftentimes one ſhall be driven of neceſſity to make choice of ſuch places as the ground will afford, by reaſon of woods, hills, marish grounds, and ſuch like diſadvantagious places as you may meet withall, and for which one can give no certain rule, but that the Generall by his wiſedome and diſcretion may make choice of the beſt advantages, which may annoy the Enemy moſt, and give the leaſt offence to his owne men, either by dazling them by the ſun, the raiſing of Duſt, and

which way the wind drives the ſmoak, both of Ordnance and ſmall shot, which though little in themſelves, yet may prove to his men great impediments and diſadvantagious. But leaving theſe things, we will now return again to our former diſcourſe, becauſe your Lordſhip is of the opinion that the Ordnance ought rather to be planted upon the wings and flanks of the Battailions then otherwiſe, which I dare not approve of, in regard that when the Troops are to encounter with the Enemy, and come up to the charge, our own men may be more annoyed by our own Ordnance (which may breed a confuſion) then the Enemies; when as the wings of our horſe which are upon the flanks ſhall come up to charge the enemie, ſo that our own peeces might puzzle them greatly, when as they are to play from the flanks, beſides the miſchief which might happen among our own men. Therefore one ought to be very carefull and circumſpect in planting them, and this is that which out of my own experience I am able to ſay upon this queſtion. Wherefore I do adviſe every Captain of the Ordnance, and Maſter-Gunners, to uſe ſome light field peeces, and ſmall Drakes, which upon every occaſion may be remooved from one place to another, and couragiouſly advanced to the places of moſt advantage, which might offend the Enemie.

Gen. *Sir*, The reaſons you uſe have given me good ſatisfaction, but I pray you reſolve me of one thing more, that is, how a Generall of the Ordnance ought to carrie himſelf in the day of Battell.

Capt. In ſuch a time the Generall is to show moſt his wiſedom, diſcretion and experience, which chiefly conſiſts herein, that he and his Lieutenant keep their train together in good order, to have a vigilant eye upon all accidents that may fall out, and to make choice of ſuch ground for the planting of his Ordnance as the Generall of the Army and he ſhall think beſt, to ſee that all things be in a readineſſe, the Ordnance well placed, and that the maſter-Gunners, Gentlemen of the Ordnance, and Canoniers do their beſt endevour, and acquit themſelves like men. It is partly alſo his charge to ſee that the whole Army be well provided with Munition, as powder, bullets, and match, becauſe the Ammunition marches under his Train, He is to be near the Generall of the Armie upon all occaſions, to receive his directions and commands, and to ſee them executed ſpeedily, and to know of him after what forra he will make his Battell, that he may plant his Ordnance accordingly, and ſo to find out hils and heights, to play over his own men, and offend the Enemie moſt. And when an Enemy ſhall preſent himſelf, and come up to the charge, to draw and plant his Ordnance as neer their horſe as poſſible may be, to hinder them from breaking in upon the diviſions of foot, taking along with him Saylors and Pioniers to help to draw up the Ordnance, and ſufficient guards to defend them, and this is that which in ſo great a buſineſſe is the charge and duty of the Generall of the Ordnance, and which may be required of him.

Gen. *Captain*, This diſcourſe hath pleaſed me well, and given me good contentment, and I am glad that I met with you upon this occaſion. *Adieu.*

THE TENTH CHAPTER.

TREATING OF THE DIVERS SORTS OF BRIDGES uſed in the ſervice of the Lords the States of the United Provinces.

MAny a brave occaſion in the warres hath bin loſt for want of Bridges to paſſe over a River a Brook, or a Moate, therefore the States for any peece of ſervice, have alwaies diverſe bridges in a readineſſe, both ſmall and great. The ſmaller ſort for any ſuddain enterpriſe, or for putting over the moat of a Town, a Horn-work, or a Half-moon are 3. as firſt a Corke bridge now not in uſe, ſecondly a Bulrush bridge, the peeces whereof are ten foot long, and ſix or ſeven foot broad, that foure men may go over them in Front, deſcribed unto you in my ſecond part in the Chapter of Approches, figure 159. whereof many peeces being joyned faſt together with ropes and Ankors, will lay a bridge over a moate, a brook, or a ditch for men to paſſe over, the third ſort is a wicker, or a basket bridge, as ſhall be hereafter deſcribed.

Moreover they have three ſorts of other Bridges, namely, a ſmall boat bridge, with beames, plancks, roaps and ankors, which are carried upon long waggons in the Army, whereof you may ſee one of them in this treatiſe, chapter the third, figure ten, of theſe we have commonly twelve, that goes along with our Army upon a long waggon, drawne with 15. couple of horſes, and a Thillet horſe.

Beſides thoſe above mentioned, there are two great bridges, the one called a punt bridge, which is laid longwaies, end to end over the Rhine, or any other great River, and the other a Maze ſchip bridge, as you ſhall ſee in the figure following.

Command then being given to the Captain of the Bridges and his men, for the firſt they lade Ordnance, and all manner of equipage in thoſe great Punts, as beames, plancks, cordage, cables, anckors, windlaſſes, winches, and all other neceſſaries, to bring them up to the Rendevous.

Now when the Captain of the Bridge is to lay a great Punt bridge over the *Rhyne*, or the *Whale*, as at *Nemegen*, *Schenckſconce*, *Weſell*, or at *Rhenebergh*, taking firſt the breadth, and diſtance of the River from the one ſide to the other, they can eaſily give a geſſe, how many of theſe punts being 50 foot long, and 10. foot broad, will ſerve to reach over the River. The firſt punt then being laid longwiſe from the edge of the one ſide of the River being faſtened to two great Stakes (and Anckers) driven into the ground, they then lay at the furtheſt end of the firſt punt, and other punt laying Brush at both ends of the punts, which riſes and falls, that horſe and waggons may paſſe over them, and alwaies faſten and bind them together with ropes and cables which ſtayes the punts, by caſting out ankors and cables into the ſtreame, to hold them faſt together, and thus they do till they have laid over 15. or 16. of theſe long punts which will reach over from the one to the other ſide of the river, at the end whereof there are caſt up two halfe moones, (if it be not neare a Town, and a Steckado or two Gats made, that none may paſſe over it without leave) having alwaies a guard to defend it and keep it from burning.

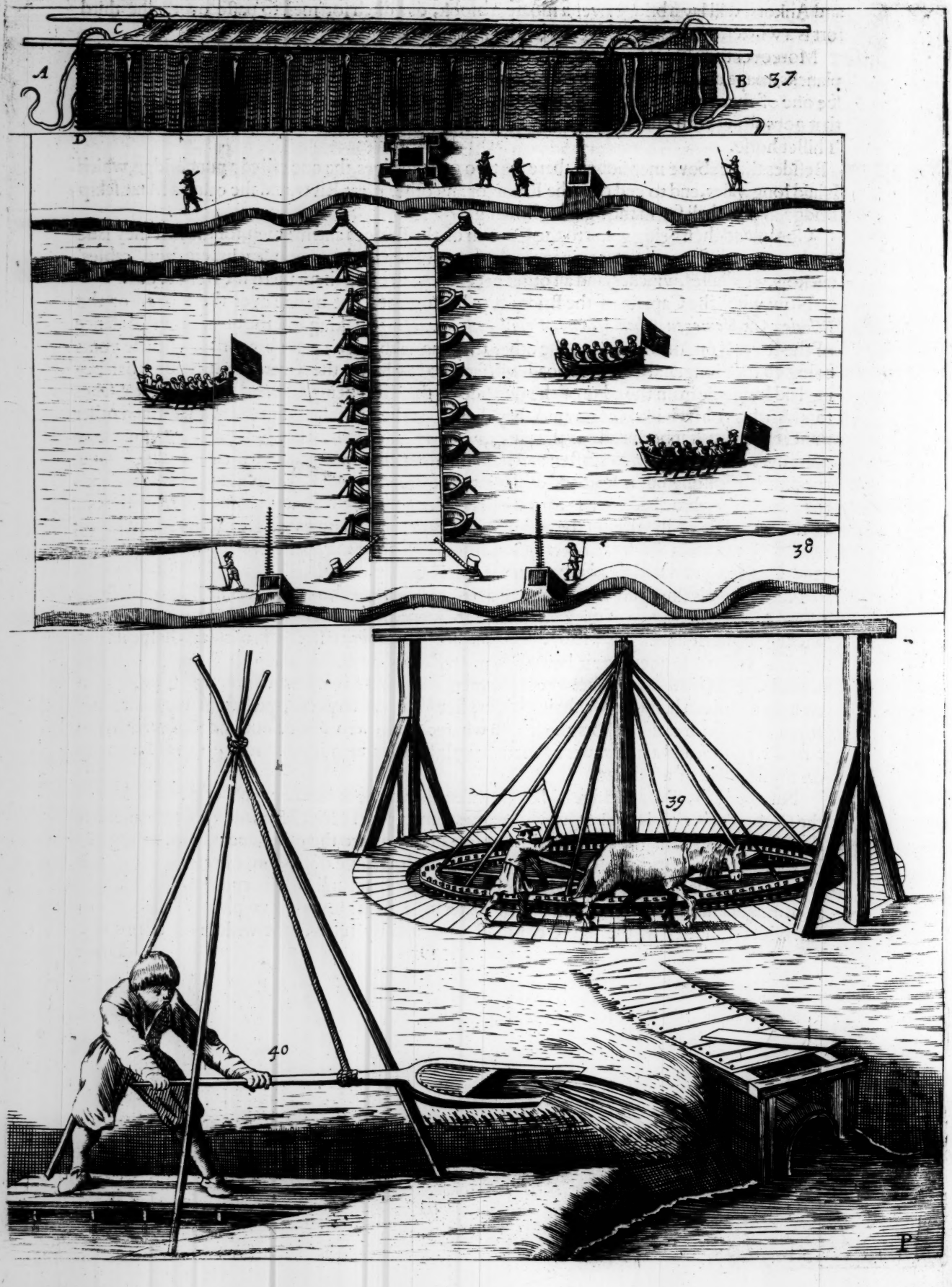
Number 37 is the figure of a peece of a basket Bridge, ſuch a one as was uſed at our laſt enterpriſe upon *Hulſt*, made of wicket, about the bigneſſe of ones middle finger, with ſupporters of wickers within it, as hedges, a foot diſtant one from another, to ſtrengthen it, and helpe it from bending, when one goes over it, being alſo matted in the bottom, and covered round about with waxed Canvas, being carried between two men, with two coole ſtaves ſome 13 foot long, as two men carries a hand barrow, being laid croſſewiſe peece to peece, and faſtened together with ropes, and at both ends anckors, the length whereof from *a* to *b* is 6. foot, and the breadth from *c* to *d* two foot and a half, and is a foot in heigth, ſo that 2 men in front may go over a moat upon any ſurpriſall of a Towne.

Number 38 is a Maze bridge laid croſſewaies, ſuch a one as our Army paſſed over the Maze at the *Grave*, *Venlo*, and *Maſtricht*, having beames ſome 15 or 16 foot long, and croſſe beames over the Maze ſchips, with plancks from the one ſide of the river to the other, and is held faſt together by cables and anckors, as the figure following of ſuch a bridge doth demonſtrate.

Number 39 is the figure of a Mathematicall Horſe watermill, firſt invented by Vitrivius, and is of ſingular uſe for the drayning out of water in Marriſh groundes and places, being drawne but with one horſe, as the figure demonſtrates, and by relieving it with freſh horſes and a

Driver may go night and day: the experience whereof we ſaw at the ſeige of the Boſch, what abundance of water twenty of them drayned out of the overflowne Meddowes and the River of the *Dummell*, which did helpe and further our Approaches greatly.

Number 40. is the figure of a *Water Scoupe*, made after this manner following, firſt you take three long pooles or Sparrs, and at the top bind them together with a match or a Cord, from the top whereof diſcends an other Cord, which is bound faſt to the haft of the Scoupe, as you may ſee, and the feet of the Sparrs put into the ground Triangular wiſe, with which you ſee the figure of a man caſting water out of a moate or a ditch. This plate *P* following will ſhew you the Figures of all that is ſaid above.

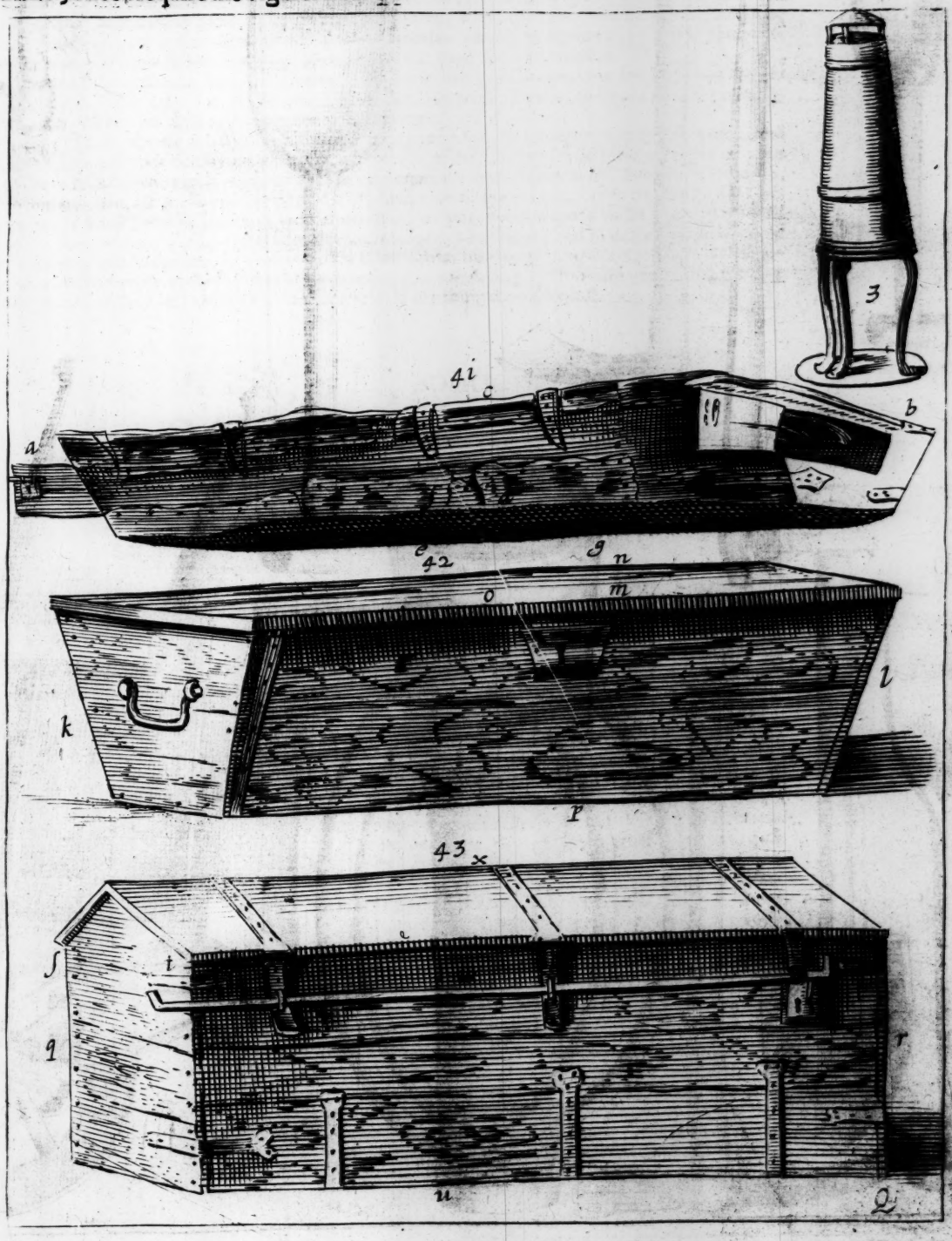


THE DEMONSTRATION OF A COPPER OVEN, A KNEADING *Trough, and a Bread Cheſt, with the appurtenances thereunto belonging.*

NUmber 41. is the figure of a new invented Copper Oven, ſet upon three Iron chimnies for the baking of bread for an Armie, having at both ends two mouths or doores, which opens and ſhuts, whereof the length of one of them from *a* to *b* is nine foot long, the breadth from *c* to *d* is three foot, the heigth from *e* to *f* to the top is a foot and a halfe, and the bottome upon which the bread bakes marked *g h* is two foot and a halfe. This Oven (as is ſaid) ſtands upon three Iron chimnies, noted 1. into which fuel and turf is put to heat this Oven, how many loafes, and pounds of bread it will bake in three houres, the liſt following will ſhow you.

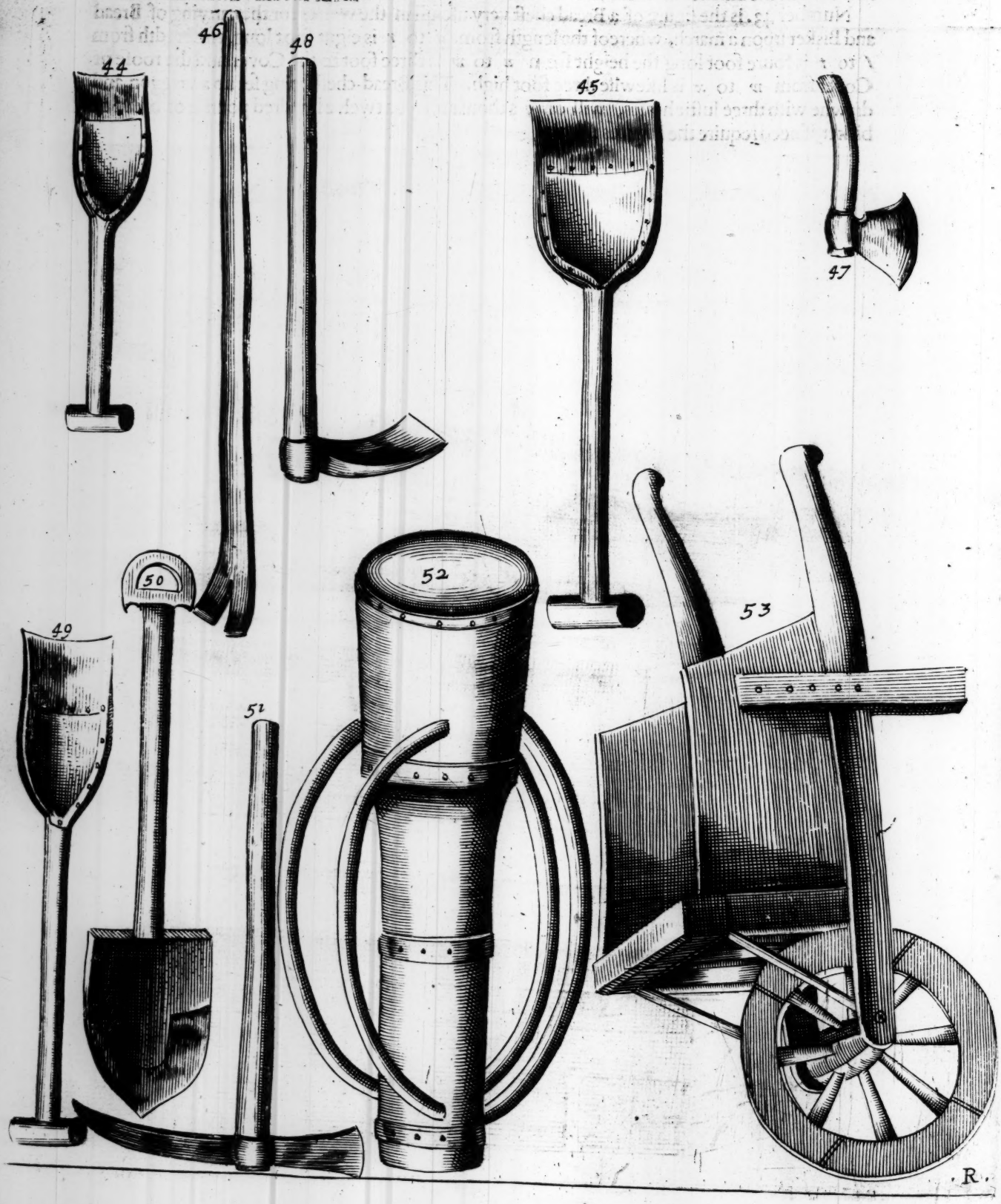
Number 42. is the figure of a Kneading Trough, which from *k* to *l* is ſeven foot long, and from *m* to *n* is two foot broad, the ledge or cover *o* is three foot high, and the bottome *p* is almoſt two foot broad, to this kneading trough, you muſt have water pailes, dow knives, peeles, to draw out the batches of bread, and all other neceſſaries belonging to a Baker.

Number 43. is the figure of a Bread cheſt very uſefull in the warres for the carrying of Bread and Bisket upon a march, whereof the length from *q* to *r* is eight foot long, the bredth from *ſ* to *t* is foure foot long, the height from *u* to *w* is three foot to the Cover, and the roofe or Cover from *w* to *x* is likewiſe three foot high. This Bread-cheſt being ſet up a waggon, and drawne with three luſtie horſes, will carry a thouſand, yea twelve hundred pounds of bread or bisket, if need require the Figures follow.



THE DEMONSTRATION OF MATERIALS USED IN OUR WARRES FOR the making of Trenches, Approches, Saps, and works of Fortification, as followeth.

Number 44. is a short plated Shovell to work in a Sapp or in a Gallery.
Number 45. is a long plated Shovell.
Number 46. is an Iron Crow, or a Goats foot.
Number 47. is a Hatchet to cut wood with.
Number 48. is a Mattock.
Number 49. is a ſpade with plated iron.
Number 50. is a Sod-Spitter.
Number 51. is a Pickaxe.
Number 52. is a two handed Rammer to drive Palizadoes into the Ground.
Number 53. is a wheele-barrow to carry earth and Sodds in, for the making up of workes Palizadoes of two ſorts you ſhall find in my ſecond part in the chapter of Approaches. figure 166.
And Frize Ruyters or Turne-Pikes in the ſame chapter, figure 165. And foot angles or foot tanternailes in the ſame chapter figure 147.
All other warrlike preparations, and neceeſſaries you ſhall find in the liſt following.



The Office, and charge of the Generall, or Maſter of the Ordnance, and all other Officers *ſubordinate* vnder his Traine of *Artillerie* Munition, and Victuals, as the particular liſts of all preparations, and neceſſaries belonging to an Armie ſhall be here demonſtrated.

THe Generall or Maſter of the Artillerie (as is showne in my ſecond part of the chiefe officers of the feild pag. 9.) is a very honorable charge and hath command and ſuper intendencie ouer all the Ordnance, Armes, Munitions, Engines, Materials & Inſtruments for worke, yea, of all things belonging to the Ordnance, and hath alſo abſolute Commaund ouer all Inſeriour Officers appartayning to the Traine of the Ordnance, as ouer the Lieutenant of The Ordnance, The Controuler, The Clarke, of the Amunition, and Materials, The Gentlemen of the Ordnance, and Maſter Gunners, Canoniers, Armores, Inginiers, The Captaines of the Pyonters, and Mineurs, ouer all Smiths, Carpenthers, and wheel wrights, ouer all Artificers, and Handie-crafts-men, and all ſuch as doe attend vpon the traine of the Artillerie, Munition, and Materials. And when the Armie is to goe into the feild, he ſends his wartanrs and patents out to all officers vnder his Charge, to meete him at the Rendevous.

Now for the better helpe, and discharging of his office, he hath a Lieutenant of the Ordnance allowed him, who in his abſence hath abſolute commaund alſo ouer this Traine, and is giuen him as an aſſiſtant, to helpe him in the execution of his Commands.

And becauſe the Generall, or Maſter of the Ordnance, is commaunded in his Commiſſion, and perticular Inſtruction, to keepe a perfect account of all great, and ſmall peeces of ordnance, Equipages, Munitions, Materials, &c. he hath allowed him a Controuler of the Ordnance, which Controuler is obliged, and bound to keepe a pertinent liſt of all the peeces of ordnance great & ſmall in the Arſenals, and Magazines, belonging to the Land, regiſtring the weight of them, the Armes, and other things, that ſtand vpon them, as likewiſe what weight euery bullet is, which euery peece of ordnance doth shoote, who caſt them, how they came to belong vnto the Land, moreouer, to keepe notice of all Carriages, wheeles, plated, or vnplated, yea off all thingselſe belonging to the traine of the Artillerie, as maye appeare more at large in his Inſtruction.

Vnto this Traine of the ordnance there are allowed two Commiſſes, or Clarkes, one for all things appertainiug to the ordnance, The other ouer the Munition, Armes, Materials, Tooles, and ouer all other neceſſaris, belonging to the Armie, as shall appeare in the liſt following.

The Councill of State, having reſolued for the feild, they ſend for the Controuler of the ordnance, and giues him a liſt of all neceſſaries belonging to the Canon, where of the Controuler deliuers a coppie of yt to the Clarke of the ordnance, who receiues charge to take on certaine Conductours to the number of ſome 40, that by their helpe and care, all things contayned in the liſt, maye be in good order taken out of the Arſenals and Magazins of the Land, and to ſee them well embarked, or put vpon wagons to be brought with all expedition to the Rendevous appointed, and becauſe the Ordnance, Munitions, and Materials maye be taken out of ſeuerall Townes and Magazins, he gives to euery Conductour his charge in writting, to lade ſuch Ordnance, Munition, & Meterials, in thoſe places as he is appointed which they are to shipp, and bring them vp to the place deſigned, as they will enſwere to the contrarie, if any thing should be loſt.

A Liſt, or Suppoſition.

What Ordnance, Munition, Matterials, and other neceſſaries, are vſefull to be carried into the feild with an Armie, as followeth.

IMprimes for batterie 6. whole Canons reinforced, 14 Demy Canons reinforced, 6 long Feild peeces, carrying a bullet of 6 lb. weight, 16 short Demy Drakes, of 24 lb. bullet, 12 quarre Canon Drakes of 12 lb. bullet, 12 short Drakes, or Sakers of 6 lb. bullet, & 14 ſmall Drakes of 3 lb. bullet making in all	80.
For 6 whole Canon spare Cariages, 6 for the 14 demy Canon Drakes 8 for the quarter Canon Drakes, 6. for the Faulconets, and ſaker Drakes 12, facit in all	29.
Spare Ship Carriages for theſe ſeverall peeces of Ordnance	20.
Spare wheeles proportionally for the Ordnance aboue ſpeecifyed of all ſorts.	20.
Fore-waggons, or Carriages	80.
Spare wheeles for the fore ſayd Carriages	22.
Block waggons & long waggons to lay, ordnance on,	25.
Spare fore and after wheeles	12.
Spare Thillers for the Block wagone	3.
Spare long waggons for the Blockwaggons	2.
Spare Axeltrees, and draughts	3.
Sledges, to draw ordnance on	8.
Fearnes, or windlaces compleat	8.
Eshellets, ormartinets.	6.
Yron Crowes, or Goats feete, handspikes, and levers of all ſoorts.	20.
Braſſe pullies, or truckles	20.
Winches, or the Endleſſ ſcrewes	12.
Yron bolts.	10.
Spare kanns of Salett oyle, for the Engines aboueſaid	6.
Tarr, or greaſe boxſes,	25.
Spare hoggs-greaſe for the Carriages.	1300.
For every peece of theſe Ordnauce aboueſaid, three ladles, three Rammers, and 3 ſponges a peece facit	240.
Spunge Copper nailes	1200.
Sheepe skinnes, to make ſpunges off	400.
Wooden levers for the Ordnance	50.
Yron Crowes	20.
For 6 whole Canons bullets of 48 lb.	2000.
For 14 demy Canons, bullets of 24 lb.	3000.
For 6 feild peeces, or demy culvering of 12 lb.	1500.
For 16 Paulconets of 6 lb. bullet	1000.

For the Demy Canon Drakes of 24 lb. 2500.
For the quarter Canon drakes of 22 lb. 2100.
For the Sakers of 6 ib. bullet 2100.
For the ſmall drakes of 3 lb. bullet 2200.
The Gabinen and Canon baſſketts, are made in the Feild, ſome 6. or 6. and a halfe foote high, and 3. foote in dyamiter, and coſts 18. ſts. d'peece Latton, Boxſes for the cartredge ſhoot for every peece 100. facit in all 4000.
Powder for theſe 80 peeces of ordnance 400000 lb.
Match in Bundles 300000.
Pouch-Barrils for the charging of ordnance with each a wodden hammer, and his dich 80.
Haire-cloaths 100.
Hurdles to plant ordnance on which are ſtiff 500.
Hand Barrowes 50.
Muſket Baskets of all ſoorts. 1200.
Woodden hoockes 20.
Thiller Harnaſe compleate 150.
Spare roapes & other harnaſe. 150.
Plated croſſe ſtaves for the drawing roapes after every couple of horſes 189.
Whip cord to binde with all 1000 paire.
Horſe collars. 800.
Drawing roapes of 40 fadome a peece 30.
Half drawing roapes 30.
Steering-roapes 60.
Windlaſſe Roapes 8.
Strycking roapes 8.
Drawing lines 70.
Neck lines to drawe up shipping, or uſe full about ordnance 40.
Ramming blocks to drive in piles, in the ground 12.
Small Rammers to drive in piles 10.
Spare roapes 12.
Great Yron hammers 7.
Beames, and underlayers for plat-formes, and other vſes. 10. foote longe 500.
Planckes for bedding & other vſes 4000.
Sparres 6000.
Spades 1000.
Showells 2000.
Axſes 500.
Hatches 500.
Hand billes 500.
Fick axſes 300.
Mattocks 300.
Yron hammers for the Greacers of ordnance 12.
Lanternes 30 lb.
Candlet 300.
Frie-lights to putt in pitcht roopes 20.
Leather pailes to quench frie with all 30.
Canvas peeces, to make blinds with 30.
Pack thred 20.
Saile yarne 4 lb.
Firkins of ronnd pitcht roopes 12.
Bolts, and clenchers for the Axeltrees of Carriages, and the Block-waggons 60.
Bolts for the Thiller carriages 60.
Bolts and clenchers for the long waggons 60.
After hookes for the carriages 20.
After Nailes 50.
Spare clenchers and wedges for the ordnance 40.
Wedges for the block and long waggons 160.
Small sheires, with bolts and rings 100.
Shieres with chaines 30.
Nailes for the bolts 150.
Great yron Nailes 150.
Yron Staples 100.
Latton Boxſes with cartriedge shott 1000.
Towe of diverſe ſorts 100 lb.
Bundles of roapes and Cordage 10.
Nailes 8 ynches long 600.
Nailes 7 ynches long 2000.
Nailes 6 ynches long 6000.
Nailes 5 ynches long 12000.
Double ſizd nailes 20000.
Single ſized nailes 20000.
Small nailes and lath nailes of all ſorts 20000.
Bundles of barre yron 400 lb.
Plate yron, and small barres for ſmiths 3000 lb.
Of ſtaue ſteele 1000 lb.
Item all ſmiths Tooles, and vtenſiles.
All Carpenrers Tooles, as many as shalbe need full.
Two great Morters, mounted vpon their Carriages.
One ſmall Morter for each 100 granades of 160 lb. ſort he great, and 100 granadoes of 20 lb. for the eſſer.
Hand granadoes to caſt into ſaps, trenches, and workes.

A liſt of ſome other

Materials, and neceſſaires, which the Clarke of the Materials vſes to carrie with him to the Feild, to make a *Magazine* of in the Army as followeth.

Pouder for Muskettiers 500000 lb.
Match in Bundles 80000.
Sow-lead to caſt muskett bullets with 50000.
Moulds of 12 bullets a peece to caſt in 50.
Haire-cloaths to cover the powder with 60.
A Great many of old peeces of ſailes to make blinds with 1000.
Spare Muſketts 500.
Spare Muſket reſts 1000.
Spare Bandeliers 500.
Spare Muſkett ſtockes 300.
Pikes 16 foote long beſides the head 2000.
Half-Pikes with Loops ſtaue-feete 300.
Corſlets, and Head peeces 300.
Armors of proofe with Caſkets of proofe 100.
Iavelines double pointed, with yron to putt through the tres of Turnepikes 1500.
Match-Hornes to blinde light matches vpon an enterprize 3000.
Running Waggons with two Wheeles, and Iavelins put through the Axeltres 300.
Short Paliſſadoes to driue into the ground with long tenter nailes 6000.
Yron hammers to ſtrick the nailes in 50.
Wodden hammers to breck open the barrils of powder 200.
Great Boorers to boore holes With 9.
Twelue firkins of foote angles, or foure ſquare tenter nailes 12000.
Yce ſpurrs With lachets 6000.

Peeces

Peeces of Bulruſh bridges for an Enterpriſe to paſſe ouer a moate, or ditch 150 peeces.
Hand-barrowes to carry ſodds 150.
Shippers hookes short and long 150.
Long yron rakes with 3 or foure teeth 150.
Great Beetlets 1000.
Water ſcupps 200.
Mathematicall water horſe miles, to drayne out water, ſe figure 37. 3.
Spiters to ſpit ſodds with all 300.
Bagger Netts to worke in a gallery 25.
Crooked yron Showels, with long hafts to warke in a Gallery 12.
Spades 10000.
Showells plated. 2000.
Mattocks 1000.
Pickaxſes 600.
Great yron hammers to breake ſtone walles with 100.
Axſes of all ſorts 1200.
Hatchets and Hand bills 100.
Great Pincers 8.
Great and ſmall hammers 38.
Yron crowes of all ſorts 30.
Draggs 25.
Nailes both greate and ſmall enenuto lath nailes of all ſorts 200000.
Lanterns and blinde lanterns of all ſorts 40.
Candles 400 lb.
Torches 565.
Fire-lights 25 and pitch roapes 600 peeces.
Barrils of pitch 6.
Barrils of Tarre 4.
Woll-ſacks 200.
Howerglaſſes 50.
Vntempered chaulk in barrils a laſt.
Ship-Katroles of all ſorts 220 ſingle.
Double Ship Katroles 70.
Drawing lines to draw Shipping againſt the ſtreame 60.
Baggs to fill earth withall vpon an Approah 2000.
Ammanition cheſts to put them in 6.
Blinds of Kanuas 150 foote long each peece 200.
Plancks, Sparrs, Heames of all ſorteg ood ſtore for ordnance, paliſſadoes, galleries, and other workes, ſome shorter, and ſome longer as occaſion maye ſerve.
Great block pile-driuers, with al their roepes, and appurtenances 2.
Tow-handed Rammers for two men to driue in pall iſſadoes with 20.
50 peeces of bulrush bridges, couvered ouer with Kanuas, with their ropes, & coards to faſten them one to an other and ankors each peeces being 10 foote long, & 6 foote broad, Corke bridges each bridg containing 10 peeces ioyned to gether, & each 10 foote long 2.
Cordage of all ſoorts 400 lb.
Windlaſes or winches 2.
Leather pailes to quench fire with 300.
Handſawes, two handed ſawes, and great timber ſawes 250.
Augers of all ſorts, wimbles, & Adaſes 50.
Good ſtore of Carpenters.
All things neceſſarie for 100 Karres, to carry earth in compleate wheele Barrowes 2000.
Spare Wheels and yron pinne for them 500.
Single ſawne plackes for the wheele barrowes 200.
Quarter ſtaues, or great Beacons to lay out the quarters with all with flaggs 200.
Haſpels, and Turne pikes, with their Iavelins ſmall and great 100.
By this Liſt abouesaid, one maye eaſſely vnderſtand, what Munitions, Materials, and neceſſaries are need full to be carryed into an Armie, of all which the Clarks of the Amunition, and the Materials shalldeliuer them out by the helpe of their Conductors, as the occaſion of the maye ſervice reqnire, and alſo receiues them into their Cuſtodie againe.

The Waggon Maſter Generall, his Lieutenant, and Conductours march vnder the Traine of the Ordnance.

BEfore the Armie riſes to the Feild, the Lord Generall ſends out writs for the Waggon Maſter Generall, that he shall ſend for his Conductours, to preſſe and take, vp ſo many Waggons, as the greatneſſe, or litleneſs of the army maye require, it maye be in every quarter 6, 7, 8. yea 1000. waggons, and each Waggon to be furniſhed with three luſty horſes, and a dryver, every Weggon having 3 gilders a day, ſo long as the Armie is in the Feild, and the Conductours 30. ſtivers per diem.

A Liſt of the Waggons to beemployed as followed.

First for the Generall of the Ordnance his Traine 150.
For the Lord Generall him ſelf, as many as his traine ſhall require.
For princes Earles, and Lords voluntiers as many as they ſhall have vſe for.
For the Lords the Deputed States for the Armie as many as they have vſe for.
For the Clarke of the Munition, and his traine Ineluding alſo the Controuler, Inginiers and Conductour two compaines of Pyoniers, and the Carpenters 120.
For the Sariant Majour Generall of the Armie 2.
For the Commiſſe or Klark of the Victuals and his traine 320.
For the Quarter-maſter Generall of the foote 2.
For the Provoſt Marshall Generall 3.
For the three principall Chiurgians of the army 3.
For the Treaſurer of the Armie 3.
For the Waggon-Maſter Generall, his Lieutenant, Conductours, Wheele-makers, Smiths, & Tow-workers 7.
For the Quarter-Maſter of the Horſe 1.
For the Lieutenant Generall of the Horſe 6.
For every Colonell of the foote ſome 3 ſome 4, according to the greatneſſe of their traine, A Lieutonant Colonell 1.
For every Sariant Majour 1.
For every Quarter-Maſter of the foote 1.
For the Preachter of a Regiment 1.
For every foote Companie in the Armie 1.
The Bridgmaſter hath vnder his charge all ſorts of punt bridges & ſmall boate bridges: the ordnance and all things elſe carried vp to the Rendevous in punts.
The Commiſe Generall or Clarke of the shipping when the Armie is to goe into feild is to ſend forth two Conductours to preſſe ſo manye Ships in every Towne and quarter, as the Generall ſhall give hrm order for, and as the greatneſſe of the Armie maye require.

A Liſt of the Baggage Shipps, and for all Officers that followes the Army.

For every Colonell and the chiefe Officers of his Regiment Ships 3.
For every troupes three of horſſe 1.
For the Lord Generall and his traine 21.
For the Lord Marshall 5.
Forforrain Lords and Earles 28.
The Quartter-maſter & the Provoſt goe in the Ship appointed for the Officers of the feild
For each Captaine of the Pyoniers a Ship 3.
For the Theaſurier of the Army 1.
For the Advocate Fiſcall & his Recorder 1.
For the chiefe Maſter Gunner 1.
For the Captaines of the Carpenters 2.
For the Prevoſt Marshall Generall 1.
For the Generall of the Ordnance 1.
For the Klarke of the Ammunition 1.
For the Klark of the Ordnance 1.
For the Klarke of the Victuals 1.
The Waggon-Maſter Generall 1.
The Captaine of the Kanon Horſes 1.
The Commiſe or Klark of the Shipping 2.
The Sariant Majour Generall of the Amy 1.
The Quarter-Maſter Generall 1.
The Controuler of the Artillerie & Munition 1.
The Controuler of the Fortifications 1.
The Inginiers, and their Aſſiſtants 1.
The Prevoſt Marshall ouer the Shippers, and ſaylours 1.
Ships allowell for the tranſporting of ſick and wounded ſouldiers 20.
Spare Ships for forraine Lords and Voluntiers 10.
For the Prevoſt Marshall Generall of the Cavaillerie 1.
For the Phyſician and Apothecarye of the armie 1.
Beſides all theſe every Companie ſo long as they lye a Ship board have three, foure, or fiue Ships comming out of garriſon till they march a land, where of ſome of theſe Ships have three gilders, ſome a rixe dalder, others two gilders a day, according to their burden.
The Commiſſe or Klark Generall ouer the Victuals, hath ſuperintendence and care ouer all manner of Victuals, as alſo Victuallers and Sutlars, which followes the Armie, and hath under his charge diverſe Conductours, and Bakers as the ſervice maye require.
First if be a long expedition, ſo that noe bread, or Victualls can come vp to the Army from the Shipping by convoy, or to any

to any towne beſeiged it wilbe needfull for him to have meale barriled vp 156 lb. in a barrill 3000 barrils
Which 3000, Barrils will require 600 waggons.
For the keeping of it in Shipping before it be loaded on waggons he muſt have 5. Conductours, and Ships 9
All neceſſaries muſt he have alſo belonging to Bakers, and Bakers.
As alſo 40. Kopper Ovens ſuch as yow ſee figure 47. each oven carryed vpon a waggon, Troughs, dowknifs, pailes
For theſe 40. Kopper Ovens ſixe great kitchin tents, with two or three chimneies in them.

Now one Oven being 9. foote longe, and 2½ in breath, wil bake in three howers a batch of 50. long loaves of bread each loafe a foote long, & 5. ynches broad, which bakes at 2 times. 300 lb of bread, and one Oven will bake in 24. howers 300 loaues of bread, which makes 1800. lb.
And 40 of theſe ovens being well heated, will backe 6. times in 24. howers, 12000. loaves, which at 4. lb. each loafe, comes for one day to 48000. lb. and for two dayes if the Armie reſts 96000. lb. a reaſonable proportion of bread 960000 lb.
Item chiefe for the Army in ſtore 300000 lb.

The

Demonſtration for the Quartering of the Generall, or *Maſter of the Ordnance*, and all Subordinate Officers marching vnder the Traine of the Artillerie.

FIrſt this Quarter is in breadth, or Front from A. to B. 600. foote, and from B. to C. is 300. foote in Depth, which never takes vp any more ground in Depth, but onely the Ordinary meaſure, for all the ſtreets in yt, are but 20. foote broade, and are marked D. E; & is the *Parke* or *empalement* of the Generall of the Ordnance is ground, with his *Attendants*, men, and *Horſes*, as yon maye evidently ſee in the raized Figure.

Num. 1. is here a *Parke* or a ſquare of 100. foote: In which parke his Tents, and Meaſures are ſett vp as the firſt is as followeth, a Hall or place of 12 foote in ſquare, and a Gallerie beyound that, and the great Hall of 6 foote long, and 6 foote broade. The great Hall ordyning roome is 24. foote broade, and 12 foote deepe. The two *Pavillions* are 12 foote ſquare. The Gallerie reaching from the one *Pavillon* to the other is 20 foote long, and 6 foote broade. The Gallerie from the great Hall to the gallerie of the two Pavillions is 10 foote long, and 6 foote broade. The Curtaines of the Tents are all of them ſixe foote deepe, and the two firſt Pavillions are likewiſe 12 foote ſquare, and the Kitchin is 24 foote long, and 12 foote broade.

F. Is the parke, or quarter of the Lieutenant Generall of the Artillerie, and for the Maſter Gunners, and Gentlemen of the Ordnance, their ſervants, & Horſes, which park is 100 foote broade, and 40 foote in depth. The Tents of the Lieut. Generall, are of this Meaſure following. The great Hall is 16 foote in depth, & 10. foote broade. The Gallerie 6 foote long, & 6 foote broade. The Pavillions are 8 foote in ſquare.

G. Is the parke for the Matterials of Amunition, as ſpades, ſhowelles, Hatches, Billes, Axes, Pickaxſes, Mattocks, planckes, beddings for Ordnances, beames, wheele barrowes, and diverſe other things. This parke is 140 foote in depth & 130 foote broad.

Number 5. is the Hutt, or a Tent for the Clarke of the Matterials.

Number 6, is a Hutt, into which all things are layd, which muſt not take wett. As Match, candles, and other things.

Number 7. is a Common Kitchin for all the Conductours, to dreſſe their victualls in, and made there to keepe the quarter from fyring.

Number 8 are the Conductours Hutts, ſome 8 or 10 foote in ſquare.

H. Is the parke into which are layd, all the materialls, inſtruments, & tooles belonging to the Ordnance, as alſo anckours, powder, and bullets, & diverſe other things, which parke is 140 foote in depth, and 130 foote in bredth.

Number 1. is the Tent or Hutt of the Clark of the Ordnance.

Number 2. is a Hutt with all manner of Amunition, belonging to the Ordnance, which ought not to receiue wett.

Number 3. is the Common Kitchin.

Number 4. is a Cave, or Sellar to laye in Gun-powder.

Number 8 are Hutts for the Conductours of the Traine.

I. Is the park or quarter for the Maſter Gunners, or Gentlemen of the Ordnance the ordinarie Gunners, & Canoniers whoſe depth is 70 foote, & 40 foote broade.

K. Is the parke or lodging of the Maſter of the fire workes, with his Conductours, & men, whoſe parke likewiſe is 70 foote in depth, & 40 foote in breath.

L. Is the parke, or quarter of the Petardiers, and their men, which is alſo 70 foote in depth, & 40 foote in breath.

M. Is the parke of the Maſter of the Batteries, & his men of the ſame greatneſſe.

N. Are three tents, or hutts for the Captaines of the Saylours, & marriners to attend vpon the Ordnance, the Attiralls, & drawing harnaſſes for the Ordnance and for the Mineurs.

O. Are all hutts 8 foote in ſquare, each for two Saylours, and two Mineurs, The ſreetes alſoo betweene every row of hutts is 8 foote broade.

Their quarter is 140 foote in depth & 90 foote in breath.

P. Is the parke, or quarter of the Clarke of the Fortifications, and his Conductours, being 60 foote in ſquare.

Q. Is the parke and quarter of the Inginiers, & their Conductours, being 80 foote in depth, & 60 foote in breath.

R. Is the quarter-maſter of this traine his quarter, or lodging being 60 foote in ſquare.

S. Is the parke or quarter of the Captaine of the Canon, or drawing Horſes, and his Conductours, being alſo 80 foote in depth, & 60 foote in breath.

T. Is the quarter, or parke for the makers of Gabions, or Canon baskets, & Muſket baskets, being 40 foote in bredth & 60 foote in depth.

V. Is the Armourers parke, & the quarter for the General of the Ordnance, with their workemen. Farriers, & Smiths belonging to this Traine, being 60 foote in depth, and 30 foote in bredth.

W. Is the Chirurgians parke of this Traine, 60 foote in depth, and 20 foote broad.

X. Is the Provoſt Marſhall of this Traine, 60 foote in depth, & 30 foote broade.

Y. Is the Farriers, or Maſter Smith his parke 80 foote in depth, & 25. foote in bredth.

Z. Is the Carters or Waggon mens and labourers, 80 foote deepe, and 35 foote broade.

a. Is the Coopers parke 80 foote in depth, & 25. foote in breath.

b. Is three Hutts or Tents for the three Captaines of the Pionniers, a. are the Hutts of the Pionniers with their Lieutenants, whoſe hutts, are in the front of the rows, and each Hutt is 8 foote in ſquare, whoſe parke is 90 foote in breath, & 140 foote in depth.

6. Is the parke, where in is ſett the carriages of Waggons, & drawing Horſes for the Ordnance, which is to be vnderſtood ſuch as are to paſſe vpon the watch, and Canon for any ſuddaine peece of ſervice, & to thend, the horſes maye not be then to ſeeke. The two Hutts within the parke marked 9. are for the Conductours & waggon Men. This parke is 140. foote in depth, & 80. foote in breath.

Thus much for the Geometricall modell of a quarter for the Artillerie.

Of the principle points handled in this third part.

THe first Chapter, of the Leagues *Alligations* and *Commixtures* of Mettalls, wherewith Ordnance are made. pag. 1.
Of the Mouldes, & founding of Ordnance. pag. 2.
The Demonstration of eight severall peeces of Ordnance, founded in the States Generall their service. pag. 3.
The second Chapter is of a Ladle, a Rammer a Sponge and feild carriage for a peece of Ordnance, and the demonstration and terciating of any peece of Ordnance, and a carriage. pag 4.
The third Chapter of a *Block*, or a long *Waggon*, and the figures of a peece of Ordnance drawne both with horse and men. pag. 5.
The rule of *Calibre* for these 8 peeces of Ordnance. pag, 8.
The fourth Chapter of a *Fearne*, or a *Ghynne*, a Scallet and a *Winch*, otherwise called the *Endlesse screw*. pag. 9.
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The sixth Chapter is observations how a Canonier ought to charge a peece, and of the Gunners service in generall. pag. 13. 14.
The seventh Chapter how a Canonier ought to Levell his peece, & to amend a bad shott. pag. 15.
A new devise by any Staff or Ruler, how to *Leuell* mount, or imbase a peece out of Mr. Nortons practize of Artillerie. pag. 16.
The eight Chapter of seuerall quadrants, a Levell, and other instruments for Ordnance and the vses of them. pag. 17. 18.
The ninth Chapter, shewing how a Canonier shall shoote Levell by the Mettall of his peece, or by the Levell *Axis*, otherwise called *point blanck*. pag. 20. 21. 22.
The first Dialogue betweene a Generall of the Artillerie and a Captayne to know this question whether a *Culvering* or a *Demy-Canon* wil carry furtherst. pag. 24. 25. 26. 27.
The tenth Chapter is of the demonstration of Morters, and the vse of them. p. 28. 29. 30.
The eleventh Chapter of the compositions, mixtures, & ingredients for the makeing of great and small *Granades*. pag 31.
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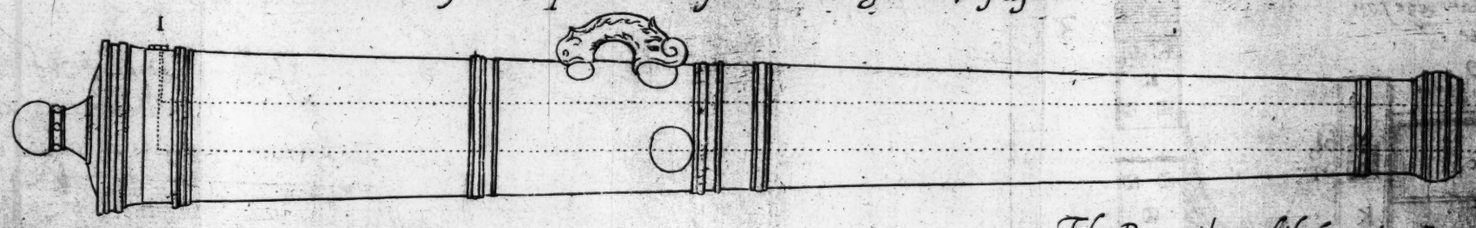
Finally, the Office, and charge of the *Generall* and *Master* of the Ordnance, and all Officers vnder his traine, wit a list, & suppositon of what sorts of Ordnance, Munition Matterials, and other necessarie, & preparations, are vsefull to be carryed into te field with an Armie. pag. 55. 56. 57. 58.
The Demonstration of a *Modell* and figure of a quarter for the *Generall* of the Orduance with all subordinate Officers, marching vnder his Traine. pag. 59. 60

The figures of foure seuerall peeces of Ordnance renforced. cast for the States of the vnited Prouinces.

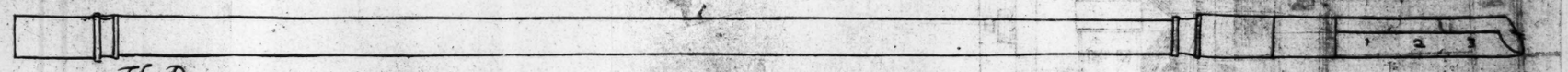
A Falconet of 2.100 pound weight the length 10 3/4 of a foote.

1



6 lb.

The Dyamiter of the boore is 3 3/4 ynches

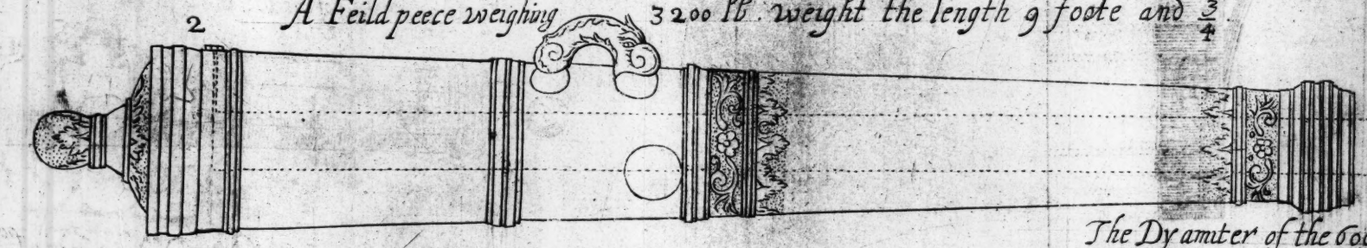


The Rammer

The ladle

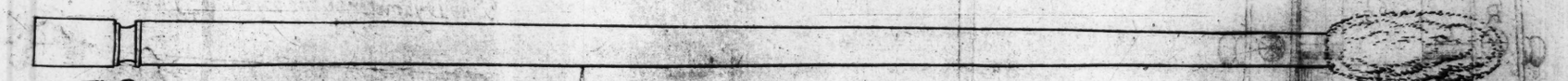
A Feild peece weighing 3200 lb. weight the length 9 foote and 3/4

2



12 lb. bullet

The Dyamiter of the boore is 4 3/4 of an ynch.

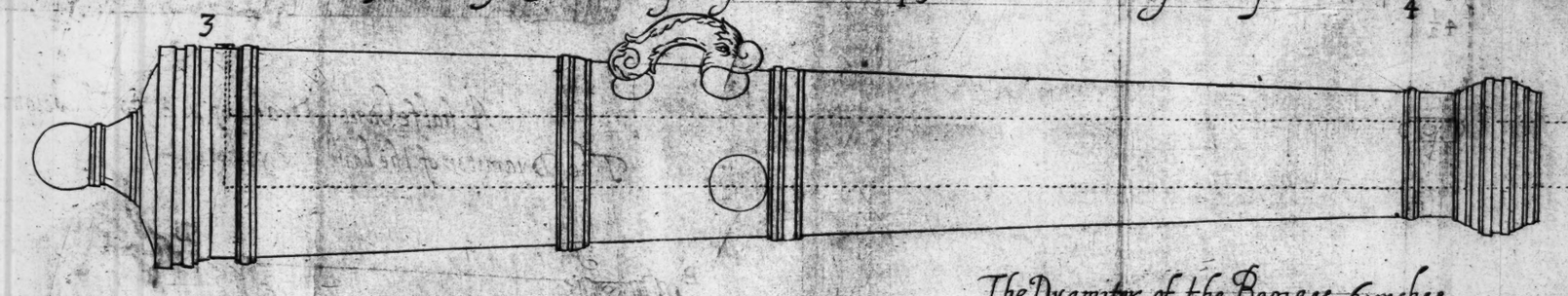


The Rammer

The stouker or Sponge.

A Demy Canon weighing about 4500 lb the length 11 foote and 1/4.

3

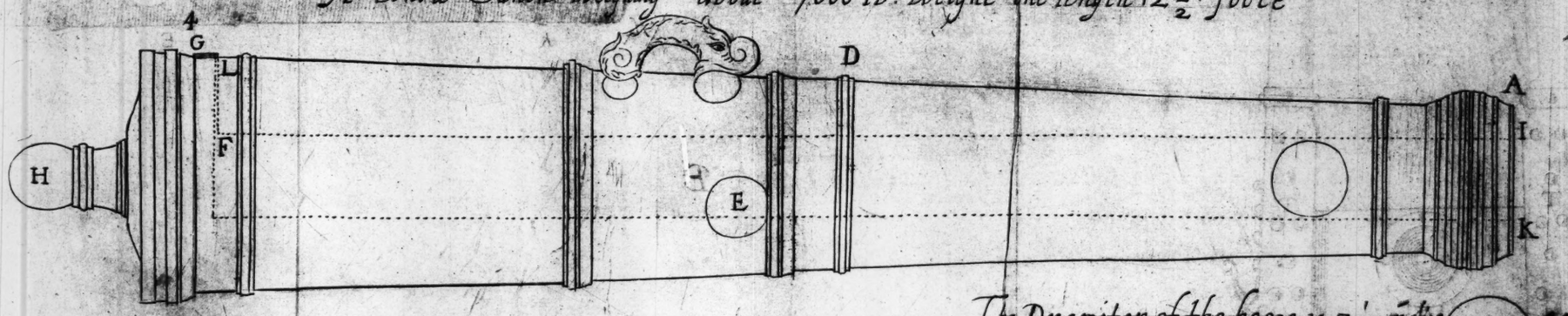


24 lb

The Dyamiter of the Boores 6 ynches

A Whole Canon weighing about 7000 lb. weight the length 12 1/2 foote

4



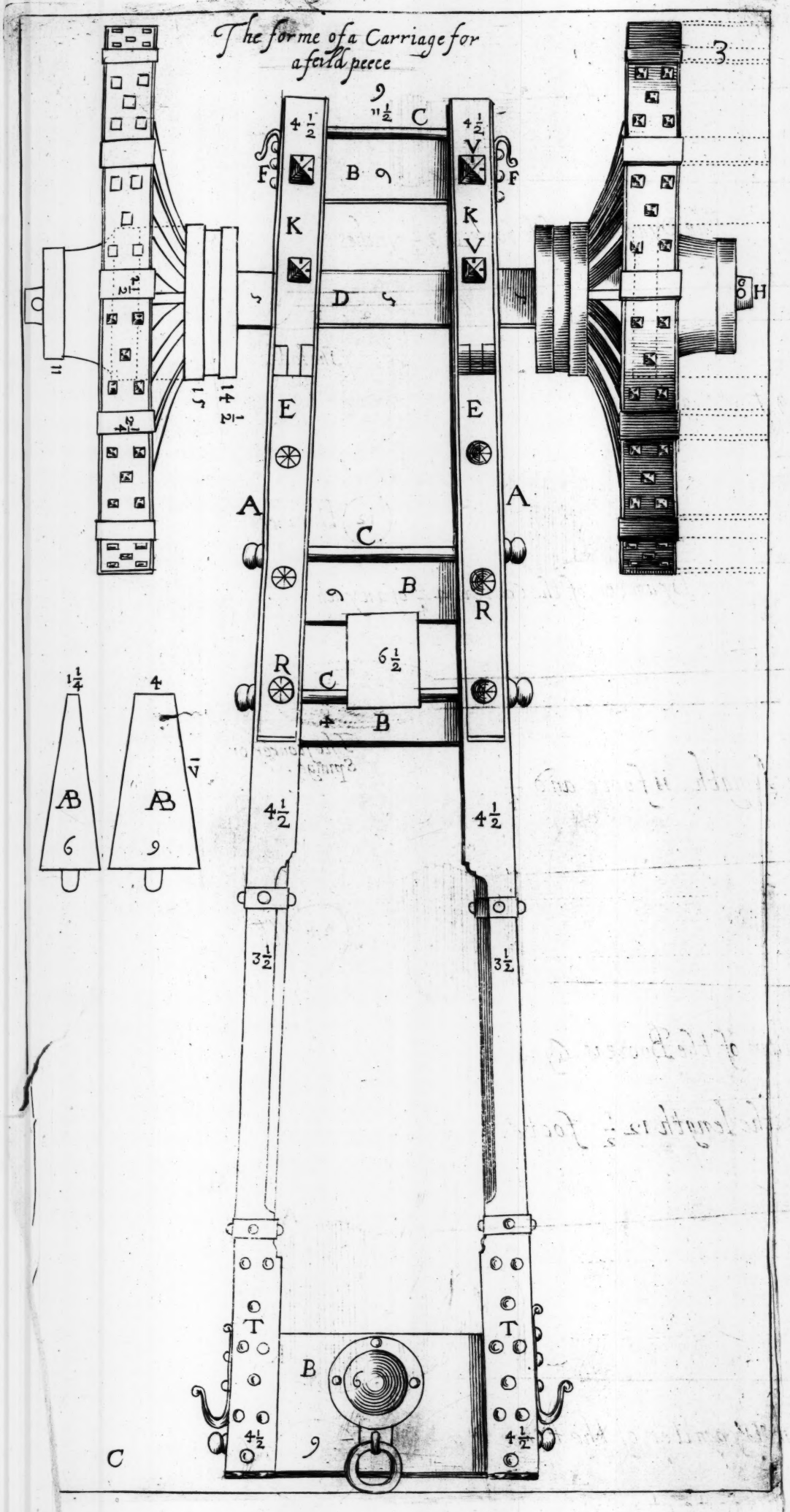
The Dyamiter of the boore is 7 1/2 ynches

48 lb

A

The Scale of an English foote at 12 ynches to the foote.

The forme of a Carriage for a field peece



C

The Dyamiter

3 lb

AD

The dy amiter of the

6 lb

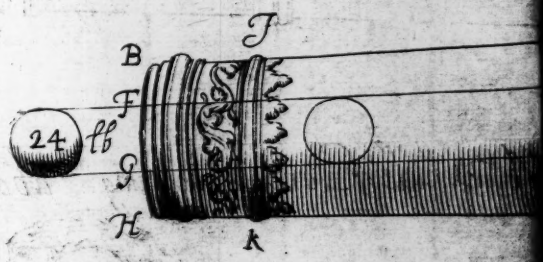
A quarter

The Dyamiter of the bore

12 lb

A halfe Can

The Dyamiter of the bo



B

Fowre peeces of Ordinance chambred.

A Drake weighing 280 lb weight, the length 4 foote.

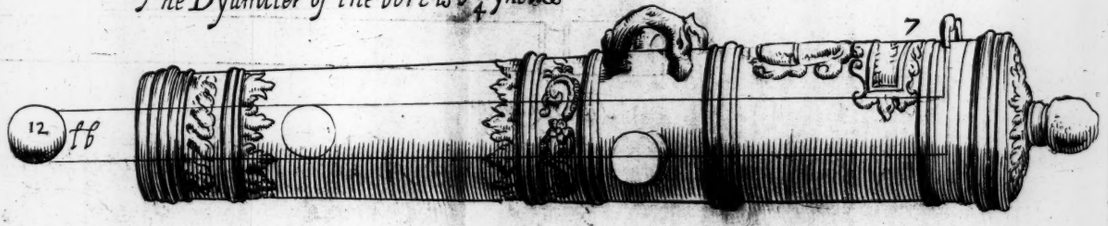
The Dyamiter of the bore is 3 ynches.

A Drake of 580 pounde weight The length 5 foote

The dyamiter of the bore is 3 3/4 ynches.

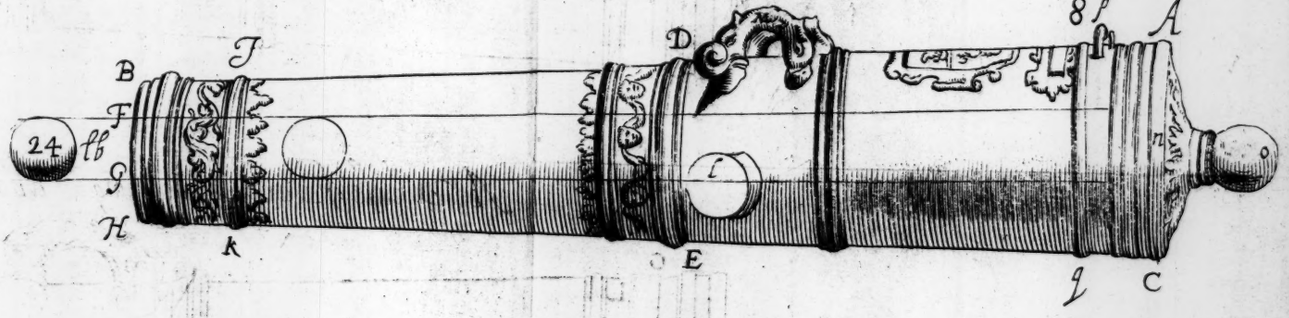
A quarter Canon Drake of 1130 lb weight The length 6 foote

The Dyamiter of the bore is 5 3/4 ynches



A halfe Canon Drake of 2250 lb weight the length 7 foote

The Dyamiter of the bore is 6 ynches.



B

THE THIRD PART OF THE PRINCIPLES OF THE ART MILITARY.

PRACTISED IN THE WARRES OF THE

UNITED PROVINCES

Vnder the LORDS the

STATES GENERALL

And his Highneſſe the

PRINCE OF ORANGE.

Treating

OF SEVERALL PEECES OF ORDNANCE, Carriages, Engines, Quadrants, Morters; Petards, as alſo inſtructions for Maſter-Gunners, and Canoniers, with divers Inſtruments and Materials belonging to a warre with their ſeverall uſes and practiſes, moſt briefly and lively demonſtrated by LETTER and FIGURE.

TOGETHER WITH A LIST OF ALL NECESSARY Preparations appertaining to an Armie, With a Quarter for the Generall of the ORDNANCE, *and of all Officers belonging to his Traine.*

Written and compoſed by *Captaine* HENRY HEXHAM, Quarter-maſter to the truly honourable, Colonell GORING his REGIMENT, for the lovers of the Noble ART MILITARIE.

The ſecond Edition Corrected and Amended.

ROTTERDAM
Printed by JAMES MOXON. 1643.

~~8825. h. 5.~~

× C. 107. k. 9.

TO

HIS HIGHNES CHARLES LODOWICK: PRINCE ELECTOVR

COUNT PALATINE OF THE RHENE, AND DUKE OF *BAVARIA.*

SIR,

AFTER I had travelled through the world in ſpeculation, by tranſlating and augmenting of ATLAS MAJOUR in English, dedicated to his moſt excellent Majeſty your Uncle, & my dread Soveraign: I could give no reſt unto my thoughts till I had undertaken ſome thing of my owne profeſſion, which might give light, underſtanding, and inſtruction, unto ſome young Gentlemen, Souldiers and others, who deſire to follow the warres, and to ſtudie this Art Military, for their princes ſervice, and the good of their Country. And where could I find a fitter place, and a better ſubject to worke upon, then in theſe United Provinces, under the command of the Lords, the STATES GENERALL, and his Highneſſe the Prince of ORANGE, which now in regard of their long Warres may truly be called a nurcery, and *ſedes belli*, for the breeding and trayning up of Souldiers, and verily how could I do better then to begin *ad principium*, with the very firſt principles, and rudiments of the Art Military, Practiſed in theſe Warres, under the command, firſt of Prince MAURICE, *of bleſſed Memory*, and now under the able conduct of that great and victorious Captain Generall of our age, his *Highneſſe* the *Trince* of *Orange* his *Brother*. Now beſides what experience my long ſervice hath gayned vnder their Commaund, for the ſpace of fortie yeeres, as an addition thereunto, I have got ſome tranſlations and extracts out of the beſt and choiſeſt Authors of our modern times, who have writ upon this ſubject, to give luſtre unto it. and having before by the aſſiſtance of God, run through the firſt two parts: I have now alſo finished my third part, concerning all preparations and neceſſaries appertaining to an Army, and ſo to put an end unto this laborious work, For in my firſt part I promiſed the right honourable the Earle of Holland, and in my ſecond part my noble Colonel, that I would go through the three whole parts, for the arming of a Souldier, *de cap en pied*, that is at all points, which now thanks be to God I have done, to the end, that ſuch as may go into, his Majeſties ſervice, your Highneſſes, or any other forrain State or Princes, may gaine ſome experience, and reape ſome benefit by my labours, which is, and was the principall thing I aymed at, For I hope, as old as I am, when theſe unhappy differences at home are reconciled, appeaſed and compoſed, that God, *vvho leads the hearts of all Kings in his hand, as the Water of brooks*, will ſo direct his Majeſties heart for your right, that his Majeſty will aſſiſt your Highneſſe, and turne his powerfull Armes another way, and make your Highneſſe Generall of a brave Brittish Armie, for the vindicating of your injuries, and the recovery of your lawfull and antient rights and inheritances, againſt the uſurpers thereof.

I will not trouble your Highneſſe any longer with a tedious diſcourſe, ſeeing my ſelfe, and thouſands of true hearted Brittaines beſides my ſelf, (whenſoever his ſacred Majeſty and our dread Soveraign ſhall lay his commands upon us) ſhall be all willing to fight in ſo juſt a quarrell, for your Highneſſe, and lay our lives down at your feet, and your Queen mothers, for the regaining of your Highneſſes Rights and Countries.

This third part then of the *Principles of the Art Military*, comes in all humility to preſent it ſelfe unto your Highneſſes gracious patronage, that though it be mean in it ſelf, yet it craves to come forth to the view of the world, under your illuſtrious name, which if it may be acceptable unto your Highneſſe, then I ſhall think my weak indevours happily ſacrificed, and acknowledge my ſelfe much obliged to your Highneſſe, and ſhall not onely be bound to pray unto the Lord of Hoaſts, to honour and bleſſe your proceedings here in this world with happy ſucceſſe, but alſo to crown you, your *Royall Mother the Queen of Vertues*, and her princely progenie with eternall felicity hereafter, beſeeching your Highneſſe to beleeve, that no creature living ſhall more heartily fight, nor more willingly die in your ſervice, then

Sir,

Your Highneſſes ever moſt humble, Obedient, and devoted Servant,

HENRY HEXHAM.

4/88

BRIEFE TREATISE

of eight ſeuerall peeces of Ordnance, as they are founded vnder the Commaund of the Lords the States Generall of the Vnited Provinces,

with their appurtenances, carriages, Engines, together with Morters and Petards, quadrants, and Inſtruction for Maſter Gunners, and Canoniers with diverſe other Inſtruments & materials, belonging to the warres, with their ſeverall vſes, and practizes demonſtrated.

THE FIRST CHAPTER.

Treating of the Leagues, Alligations, and Commixture of mettals, wherewith Ordnance are Caſt, and made in theſe Countries, and elſe where.

THe *Alloye* wherewith our Ordnance is made here in theſe Countries, is commonly old caſt *braſſe peeces*, ill proportioned, burſt, or made vnſeruiceable with too much Shooting, and therefore, muſt be refounded into ſome better, and more ſeruiceable *formes*, or are ſuch perhaps, as are too great for ordinarie Carriages and bullets. If theſe old braſſe peeces be of too fine a *mettall* (wich yet is ſeldome found) the Mr. *Founder* maye mingle ſome ſlighter copper amongſt it; yea ſo much as he in his iudgment ſhall think fitting: ſo that the Ordnance, which he makes be anſwerable to their proofe.

Our newe Ordnance then being founded with theſe new *alligations*, and *alloyes* are commixted with three fourth parts of red Copper, made vp in Sowes one fourth part of Bell mettal caſt alſo in Sowes, and one ninth part of the fineſt Cornish tinne you can gett.

Theſe bricks are peeces of red copper weighing, about 50 lb. weight, caſt after the faſhion of a square footed pauement, and your great Sowes, are peeces of other Copper, melted one timeleſſe, then your brick Copper, where of ſome of them weighes 200, 300. yea the greateſt 600 lb. a peece, The is tinne mix ed amongſt the Copper, and Bell-mettal, that they maye run ne the better in melting, which makes your peece more ſolid and firme.

But in Italy & nor Alexander Bianco (*as maſter* Norton *oneof his matias, maſter Gunoners, and Enginier citeth in his practize of Artilerie*) *ſaith, That the beſt* Alligations *of theſe mettals for Ordnance is for every 200. lb. of Copper 20 lb. of tinne, and 5 lb. of braſſe, or Latton is to be mixted therewith. And* Digeo Vſſano *a Spainyard, Captaine of the Ordnance in the Caſtle of* Antwerpe, *in his inſtruction of Artilerie affirmeth, that the beſt* ligature *for Ordnance is 100 lb. of Copper, 8 lb. of tinne and 5 lb. of Latton, and 10 lb. of Sow-lead, affirming that lead being tough & cold, maketh the peece become hard. But le* Sieur de Briſſac, *a french man in his* militatie diſcourſes *ſaith, that the french, Founders vnto every 100 lb. of Copper doe either ad 20 lb. of Bell-mettal, which is 25 pound of Tinne & Lead for 100 lb. of Copper, orbraſſe, or elſe 10 lb. of ſoft tinne to every 100 lb. of Copper.*

The Lords the States have in the Hagh a very brave founderie, and a work-houſe ioyning to it, in which they doe all their maſſive *workes, and behinde that a ſpacious roome, where they Set and place all their carriages, which is kept faire and dry, and beſides the* Maſter Founder *hath a houſe to dwell in, all which belongs to the Land.*

The Maſter Founder *muſt be very carefull in makeing choiſe of his powders, & Earths wherewith he is to make his* Mouldes *for the Caſting of braſſe Ordnance in, that they be able to reſiſt the fire, and receiue the melted mettals: So that they maye render them to be caſt, and founded neately, without being Subject, either to be diminiſhed, crackt, or peeld, when they ſhalbe nealed, which is ſuch a matter, as without experience cannot be done well. Wherefore, I Wil conclude with maſter* Norton *in his practize of* Artilleric, *that good Earths are neither fatt, nor leane, but betweene both, and of a fine and ſubtill graine or mould, which ſoone dryeth, and remayneth firme, without breaking, being able to reſiſt the* vehemencie *of the fire, and ſuch Earths are moſt commonly of a yellowe, or a red colour.*

Now to finde ſuch Earths, as are fitt for your worke, it behoueth you to ſinke diverſe pits, & Caues vnder ground, which have not bin much ſtirred. And after you have begun your worke, and Compounded your Earths *in a bouke, or heape, and wett, and moiſtned them like* paſte, *begine then to heate them with a rod of yron, as the Potten vſe to doe their Claye. Then take two third parts of the whole* lumpe, *and mixe it with* lint *of linnen cloath, and then beate the ſame together, vntill they be well* incorporated, *that they maye appeare all one* ſubſtance, *and if any ſmall ſtones ſhould chance to fall amongſt it, then pick thene out, or bruiſe them, as ſmall as maye be, that the powders being well tempred, maye ſerue for your moulds and formes.*

Of makeing of moulds for the founding of Ordnance.

THe Maſter Founder having prepared, and reſolued of what kind, and what ſort of that kinde the Ordnance is, which he intends to caſt, he is then firſt to make a perfect Modell there of, either of timber, or of Earth, orboth, with all the Mouldures, Ornaments, & compartiments; euen as you would have the peece to be, which you muſt thinnely annoint with ſoft hogt-greaſe, and then cover it over with a Colume of the afore ſaid tempered Earthp, made and dryed by little and litle, augmenting it, vntill it be of a Competent ſtrength, and thickneſſe. This Colume muſt be made ſo, as it may be taken into two or more parts, to the end, to take the ſaid modell, or patterne out of yt, and it is to beforti-fyed on the outſide, with plates of yron, at long as the Chaſe of the peece is, and with yron Wyres an inch each from an other, and laſtly with y-ron Hoopes a foote, or two aſſunder, to knock off, and on, as occaſion ſhall require. Their muſt alſo be a ſmooth, and equall Cillender, whoſe Dyamitre muſt be iuſt the beigth of the Bore, and made of the ſame Earth, moulded vpon a ſtronge Iron ſquare Barre, and vpon a Cord woulded about the ſame, to make therewith the ſoule, Concaue or hollow Cillinder of the peece, by placing yt (by helpe of the Baſe, and Muzzle ring) exactly in the midſt of the Vacuity of the outermoſt Colume, which whenthe Patterne, or Modell Shalbe taken out, will remaine hollow, to receiue the metrall, that muſt make the bodie of the peece. All theſe muſt be well ioynted together, polished ſmooth, dryed Nealed, that the mettall maye runne fine, and come off ſmooth and neate.

Laſtly, the patterne of the breech, with all the Mouldures, and Caſcabell, is in like manner to be Couvered ouer, by litle and litle with the ſame tempered Earth, which muſt afterwards be Luted neatly, and ſtrongly to the breech end of the outter Colume: all which Mouldures, Rings, Armes, Deviſes, Flowers, Trunions, Dolphins, and Circles, maye be at pleaſure added there vnto, vpon the patterne, either with waxe, earth, or playſter, and ſo the perfect Impreſſion thereof wilbe receiued by the Concavity of the out ward Colume, keeping ſtill the due preſcribed proportion of the peeces (yow intend to caſt) accordingto the kind & ſort thereof, for the reſt ſe maſter Norton in his 21, & 22 Chapters of the practize of Artillerie.

Having thus digreſſed, I will returne againe to my former matter, and giue the gentle Reader to vnder ſtand, that the States have Conditioned with their Maſter Founder, that he ſhalbe at the charge of makeing all Mouldures, Formes, caſtings, borings, and finding of firing, for which he hath from the States fix gildens, or 12 hillings ſtarling, for the founding, of 100 lb. weight; ſo that for a whole Canon, which weighs 7000 lb. weight, he hath 840 gilders for him and his men, the reſt proportionally. Now when any old braſſe peeces are to be caſt, they are deliuered to him by weight, and he is allowed him ten pounds in every 100 lb. weight for droſſe and waſt: for you muſt vnderſtand, that Copper & braſſe have much more droſſe in them, then gould or ſilver, becauſe the finer the Alloye is, the leſſer it will conſume by fire.

The greateſt number of new peeces caſt in the States Founderie at the Hagh, euery yeare by the helpe of ſome, 20 men are ſixe whole Canons, twolve half Canons, and ſixe long Feild peeces, or demy Culvering, makeing in all the number of 24 peeces of Ordnance. But of late yeares they caſt diverſe ſorts of french ſhort Demy Canon, and ſmaller Drakes, as now the occaſion of ſervice requires.

Theſe Ordnance being founded and made, the Maſter Feunder is to deliuer them to the States vpon Proofe in the preſence of ſome Commiſſioners, and the Controuleur of the Ordnance, who are to ouerſee them, and to take care, that the peece, which is to be tryed, be well loaded with her due weight of powder, and bullet, and rammed well home.

The proofe of a whole Canon which weights 7000 lb. weight, and carries an yron bullet of 48 lb. weight muſt be charged with 32 lb. of fine powder, and with the bullet aboue ſaid well rammed home; but the ordinary charge then of it wilbe noe more then 20, 19, or 18 lb. of fine pouder at the leaſt: A halfe Canon which weighs 4500 lb. weight and ſhootes a bullet of 24 lb. weight, the proofe Shott muſt be 16 pounds of fine powder & the ordinarie charge 12 lb.

A Feild peece, which weighs 3200 pound weight, carrying a bullet, of 12 lb. muſt be loaded with nine pounds of fine powder, but the ordinarie charge is noe more but ſixe pounds.

The Faulconet, that weighs 2100 lb. which carries a bullet of ſixe pound weight, muſt be loaded with 4 and a halfe lb. of fine powder for it proofs ſhott, and with 3 lb. for its ordinarie charge.

Note alſo, that a Canon, which ſhoots a bullet of 48 lb. muſt be bored fot a bullet of 52 lb.

Weight, A Demy Canon, which carries a bullet of 24 lb. muſt be bored for a bullet of 28 pound.

Weight, A quarter Canon, which carries a bullet of 12 lb. muſt le bored for a bullet of 16 lib.

A Faulconet which carries a bullet of 6 lb. weight, muſt be bored for a bullet of 8 lb.

Your whole Canon, and Demy Canon, are commonly peeces for Batterie, vſed at ſeiges for to make a breach, but your Feild peeces, and Drakes are to be drawne to ſome ſuddaine peece of ſeruice, as in the day of Battle, vpon a Paſſage, or vppon Plate Formes, & Batteries made vpon the line of Circumvalatione, or for the defence of a Campe, when an ennemy is at hand, and the reſt of the ſhort chambred Drakes likewiſe.

A Canon or a ſmaller peece of Ordnance, maye ſhoote in 12 howres ſome 80 ſhoot, yea 100, if it be not Ouer Heated, but after yow have made with it ſome 10 or 12 ſhott at the moſt, it muſt have a Gooling time, by caſting ouer the breech of it a Danck hair cloath a prette while, and that will coole it enough.

For a whole Canon mounted vpon a block waggon, or vpon its owne Carriage, it is commonly drawne in theſe hollow, and marshie Countries, with a teeme of 15 couple of Buſtie horſes, beſides the Thiller horſe, making account, that euery couple of horſes, muſt drawe for their shares 600, yea 650 pound weight if they be well putt to it. A Demy Canon with eleuen couple and a Thiller horſe, a quarter Canon with eight coupple and a Thiller horſe, & a Faulconet with foure couple & a Thiller horſe, and your ſmaller Drakes with a number proportionable to the weight abouesaid, yea euen to a ſmall Drake carrying a bullet but of one pound weight, is drawne but witha Thiller horſe. The length of the chaſe of euery peece both Reinforced & Chambred is noted aboue its figure.

The Demonſtration of the eight peeces of Ordnance, which are in moſt vſe, vnder the Lords the States ſervice.

And firſt of foure peeces of Ordnance reinforced Plate A.

NVm. 1. is a Faulconet weighing in mettal 2100 lb. weight, being 10 and three quart of a foot long, which shootes an yron bullet of 6 lb. weight, which being layd leuell by the mettall, otherwiſe called the Horiozontall levell 800, by the Levelaxis, or diſpart, commonly called point blanck 400, & at the bigheſt range 4090 paces at 2 and a halfe foote to the pace.

Number 2. is a Feild peece, or a quarter Canon, weighing 3200 lb. being 8 foote and three quart of a foote long, wch shootes an iron bullet of 12 lb. weight, & carries by the mettall 600, by the Axis or point blanck 300, and at the higheſt range 3800 paces.

Number 3, is a Demy Canon, weighing 4500 pound weight being 10nd a halfe foote longe, carrying an yron bullet of 24 lb. weight, which will shoote levell by the metall, or Horiozontall levell 800, by the Axis or point blanck 400, and at the higheſt range 6000 paces.

Number 4, is a whole Canon, weighing in mettall 7000 lb. weight, carrying a bullet of 48 lb. weight, which shoots by the mettall, or Horiozontall levell 1000, by the Axis, or point blanck 500, and at the higheſt range 7000 paces at two foote and a halfe to the pace.

I referre the Reader to the other ranges ſpecifyed in the Quadrant and table fallowing.

Of the other foure peeces of Ordnance, called Drakes chambred Plate B.

NVmber 5. is a ſmall Drake, weighing 280 lb. weight in mettall, and is 4 foote long, carrying a bullet of 3 lb. weight, charged with one lb. of powder, which will shoote levell by the mettall 176, by the Axis, or point blanck 40 and at the higheſt range 800 pace.

Number 6. is a Drake weighing 580 pounds, is 5 foot long corring a bullett of 6 lb. weight loaded with 2 lb. of powder, which will shoote levell by the mettall 196, by the Axis or point blanck, 100, and at the higheſt range 2500 paces.

Number 7. is a quarter Canon Drake weighing 1130 lb. weight in mettall, is 6 foote long carrying a bullet of 12 lb. weight, charged with 4 lb. of powder, which will shoote levell by the mettall 264, by the Axis, or point blanck 140 and at the higheſt range 2500 paces.

Number 8. is a short Demy Canon Drake, weighing 2250 lb. weight in mettall, is 7 foote long, carrying a bullet of 24 lb. weight, with 6 lb. of powder which, will shoote by the mettall, or Horiozontall levell 340, by the Axis, despart, or point blanck 180 and at the beſt, or higheſt elevation 2770 paces. Note by the waye, that the longer the chaſe of a peece is, being reinforced *& well charged, the further it will carrie its bullet, and the ſtroak the more violent, as you maye ſee by long* Culverings, *and* ſlinghs *of ſome 24 or 25 foote long in chaſe, whereof the experience hath bin tryed at* Arnham *in* Gelderland, *where a long* Sling *lay vpon a Bulwarke, which shott from* Arnham *to* Nemegen *being 6 English miles diſtant one from an other. Againe, the Shorter the chaſe of a peeces is, as in theſe* Drakes, *the shorter it carries the bullet, as you maye ſee by their ſeuerall ranges.*

Yet this doth not alwaies hold true for Count Maurice Prince of Orange *of bleſſed memorie, tryed ance a half Canon vpon the* Strand at Scheveling, *giving it the due charge of powder, and cauſed the Canonier to levell in vpon its higheſt range, at 6000 paces, to trye this concluſion, to ſee how farre it would carry, when it was shorter, cauſſed ſome two foote and a half of yt to beſawne off, made it be loaded againe, shoot it off, and found that it carried it bullet as farre as it had done before.*

To conclude, with Touch-holes, I have ſeene in Oſtend vpon the Weſt Bulwark, that ſome touch holes of Canon, were blowne ſo great with often and continuall shooring, that I have putt my fiſt into them. Now ſuch a touch hole being blowne ſome three or foure inches, maye eaſely be remedied. For if yow bore the

hole round, and driue in a ſcrew of yron into it, as thick as your finger, and in the midſt of the ſcrew aboue ſaid, bore a ſmall Touch hole in yt, yow ſhall finde this to laſt longer vnblowne, then any other way, which hath bin invented, for now when ordnance are caſt a new at this day, for the preventing of this two much blowing, they yſe now to make ſuch a touch hole with a ſcrew, as is here mentioned which will not ſo ſoone be blowne great, and as your braſſe or Copper Touch holes will.

THE SECOND CHAPTER.

Treating of a ladle, a Rammer, of a Sponge, and a Feild Carriage for a peece of Ordnance as ſhall be demonſtrated vnder the Carriage.

THe figures of a ladle, a Rammer, and a Sponge is repreſented vnto yow vnder the Fanlconet, and feild peece, with their iuſt lenght, and thickneſſe, after which forme yow maye make all others for what ſorts of peeces yow pleaſe, and with all obſerue, that the bigneſſe of them muſt be according to the Dyamitre of the bullet which your peece carries. The lengh of the ladle vnder the feild peece with the ſtaff and Rammer is 11 foote, and 9 inches & a halfe long. The opening of the ladle is a foote and a fourth part of an inch. The braſſe plate rounded to the ſtaff, and to the height of the ſhoot, and due vent allowed is fiue inches. The ſtaff of the ladle 3 ynches thick made of ſoft faſt wood as Aspe Beech or willow. The Rammer B is 4 inches, turned with hard wood, and the length of the copper ladle a foote and ten ynches, the ſtaff to the neck on both ſides is 3 inches thick. The Dyamitre of the bullet is traced out with pricks coming downe from the ladle marked 1, 2, & 3.

The Spunge C. is couered with rough sheeps skinns wool, and nailed to the ſtaff with Copper nailles ſo that it maye fill vp the Soule or Concavity of the peece when it is to be ſcowred and cleared. Note alſo that the Copper ladle for a peece of ordnance muſt be threetimes the length of the Dyamitre of the bullet. Such a ladle coſts the States 6 gl. 10 ſtivers, vidz. The ſtaff 2 gl. and 14 ſtivers for a whole Canon, for a halfe Canon 5 gilders, for a feild peece foure gilders 10 ſtivers. And the Rammer, the ſtaff, and the Sponge or sheeps skinne will coſt two gilders 14 ſtivers.

Yow have alſo in the plate B. figure, 9 repreſented vnto yow the figure of a Carriage for a feild peece with all the Dimenſions, ioynts, and parts belonging to yt.

The Naues, The cheeke, called limbres, and the wheeles are made of Elme, but the Tranſoms, The Axeltrees, the ſpoakes of Oaken timber, and the fore carriage of the wheeles are made of the ſame wood, as the former are, but the Tranſoms are elme and the croſſe beames of Oake as the ichnographie of the Carriage Figure 9 showes.

The Lords the States have agreed with their Maſter Carpentes, to make them a Carriage for a whole Canon for 134 gilders 10 ſtivers, namely the two ſide peeces 15, or 16 foote long, 17 inches broad, and ſix and a half inches thick, for 59 gilders, and to every carriage foure tranſoms for 6 gilders. An Axeltree for 4 gilders 10 ſtivers, The two wheeles 37 gilders 16 ſtivers, for the framing and makeing of the carriage for a whole Canon 27 gildets 10 ſtivers, for an Axekree 1 gl. 10 ſtivers. for the makeing, of the wheeles 10 gl. which comes to in all, as aboue ſaid to 134 gilders 10 ſtivers, and ſo the reſt of all Carriages proportionally.

The Demonſtration, or Terciating of the whole Canon, Num. 4. and alſo of the Demy-Canon Drake chambred, Num. 8.

with their ſeuerall names and parts diſcribed.

Note firſt that a peece of Ordnance is diuided into three parts. 1. The Breech, or chamber 2, the trunions, & 3 the Muzzle, *or neck, and the length of the whole peece is called the* Chaſe, *or* Colume.

A. is the Cotuish, *brow, or* baſe ring *of the peece.*

B. is thee peeces neek. C. the peeces Boutill, *or* Aſtragall *called the muſſel* Ringe.

D. The Reinforced ring, *E The* tronion-ring; *& theſe 2 tronions are two* ſpyndles, *vpon which the peece lieth in its carriage. E H. is that part of the peece, betweene the Breech, the tronions, & the eares.*

F I. is the Calibre, *Mould, or the bore of the peece. G. is the* touch-hole, *and all the metall behinde the* touh-hole, *is ealled the* Breech. *F H. is the* Coile *of the peece. H. The* Caſacabel, *or the out moſt* pommel *or button of the peece. F L. is the* mettaline *ſubſtance, or thickneſſe of the* Coile, *about the breech of the peece about the* concave Cillendet, *otherwiſe, called the* Sowle *of the peece.*

M. is the mettaline Subſtance *at her eares, and Staues of* Gravitie, *by which shee is heiſed up into her Carriage. So much of her bore, as containeth the powder, and shoot, is called the* chamber, *or charge* cillender; *the reſt the vacant* cillender, *& all the rings circles, and eminences at her mouth & breech are called the* Friezes. *To conclude, the ordinarie Canons of Batterie is ſeuen eights of ſubſtance in their chambers fiue eights at their. Trunions, & three eights at the muzzle, or necks of the* Dyamitre *of their* Calibres, *or boores in thickneſſe of mettall. And thus much briefly for the demonſtrating of anyother peece of ordnance what ſoeuer.*

practi-

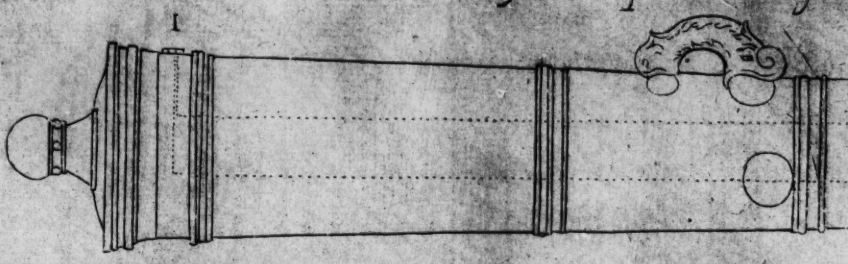
T

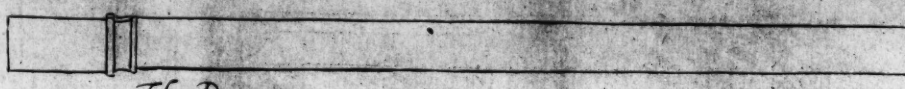
H

The figures of foure seuerall peeces of Ordnance

A Falconet of 2100 pound weight

1

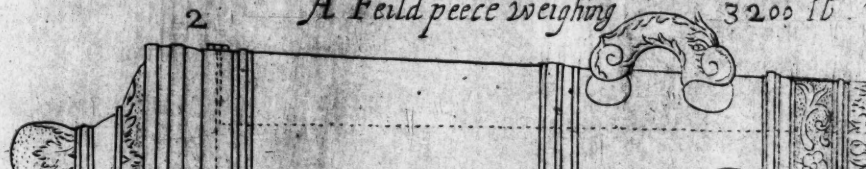


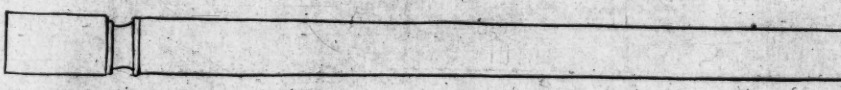


The Rammer

A Feild peece weighing 3200 Pt

2

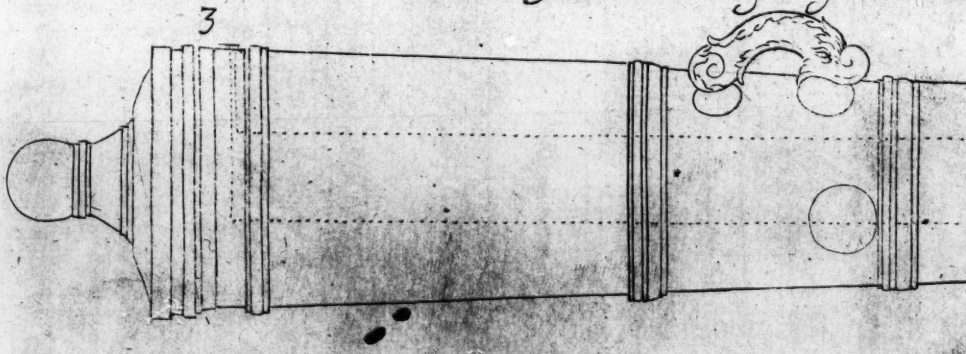




The Rammer

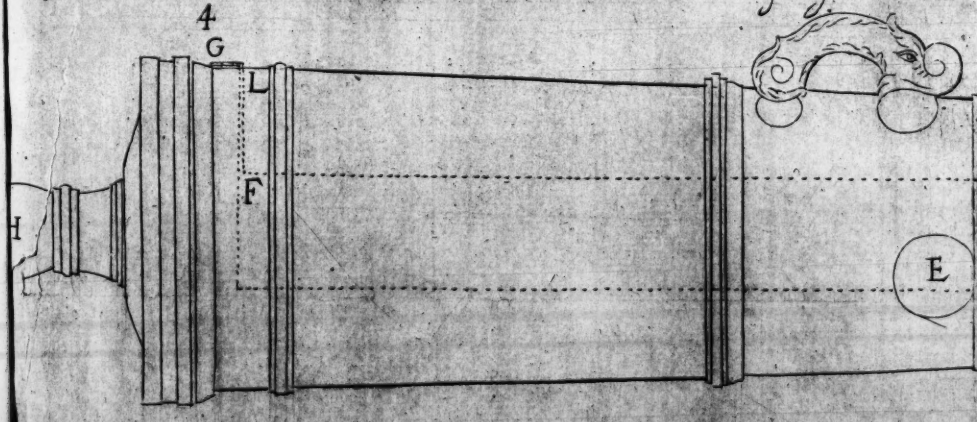
A Demy Canon weighing abou

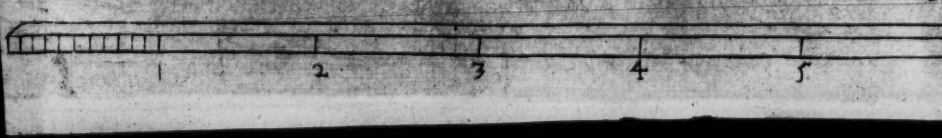
3



A Whole Canon weighing about

4





renforced cast for the States of the vnited Prouinces.

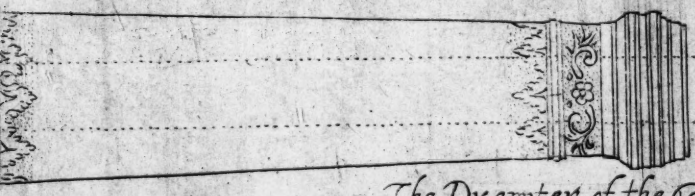
the length 10 3/4 of a foote

6 lb.

The Dyamiter of the boore is 3 3/4 ynches

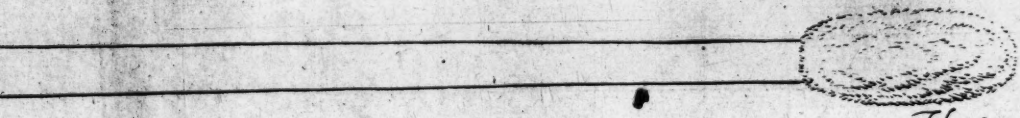
The Sadle

weight the length 9 foote and 3/4



12 lb. bullet

The Dyamiter of the boore is 4 3/4 of an ynch.



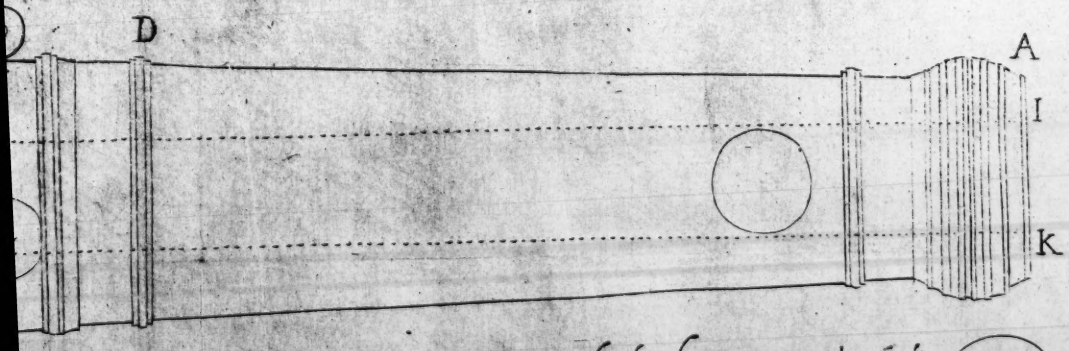
The scourer or Sponge.

bout 4500 lb the length 11 foote and 1/4.

24 lb.

The Dyamiter of the Boores. 6 ynches

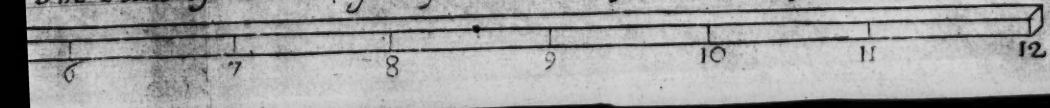
ut 7000 lb. weight the length 12 1/2 foote



The Dyamiter of the boore is 7 1/2 ynches

48 lb

The Scale of an English foote at 12 ynches to the foote



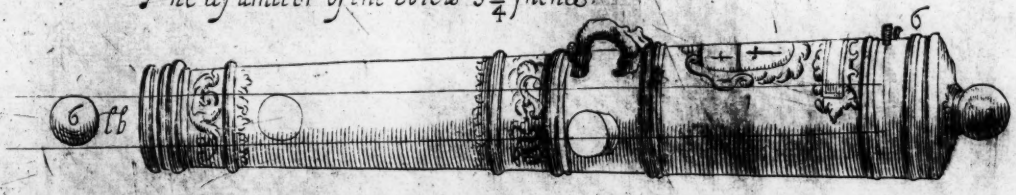
Fowre peeces of Ordinance chambred.

A Drake weighing 280 lb weight, the length 4 foote.

The Dyamiter of the bore is 3 ynches.

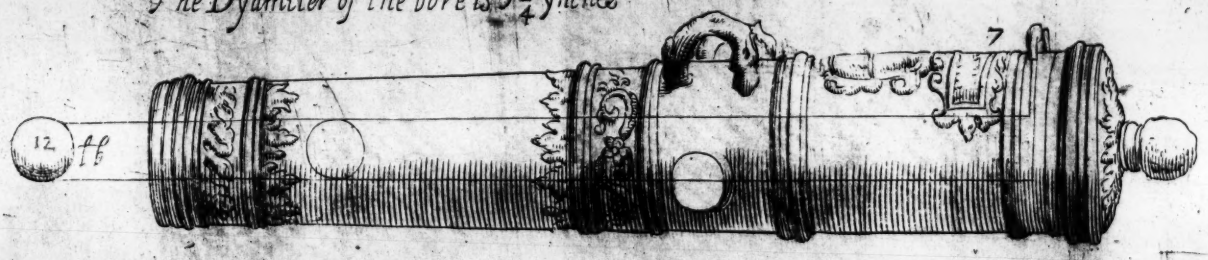
A Drake of 580 pounde weight The length 5 foote

The dyamiter of the bore is 3 3/4 ynches.



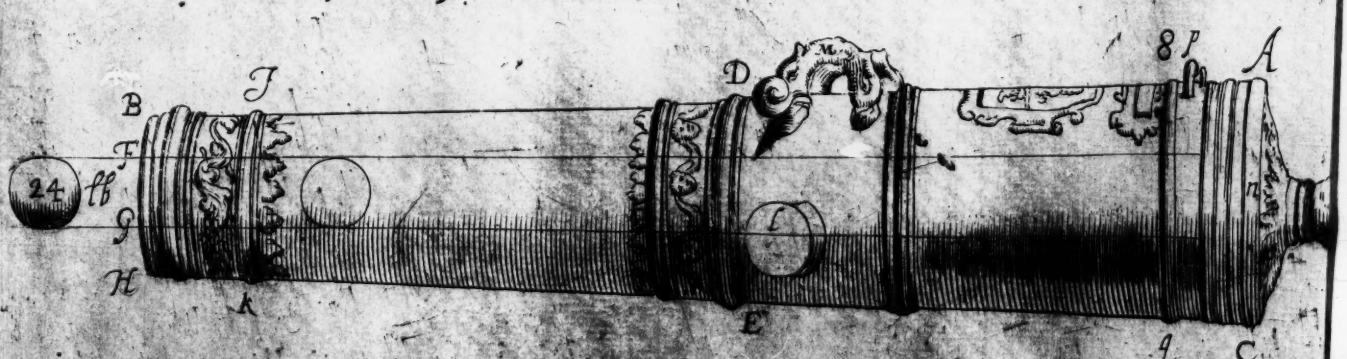
A quarter Canon Drake of 1130 lb weight The length 6 foote.

The Dyamiter of the bore is 5 3/4 ynches

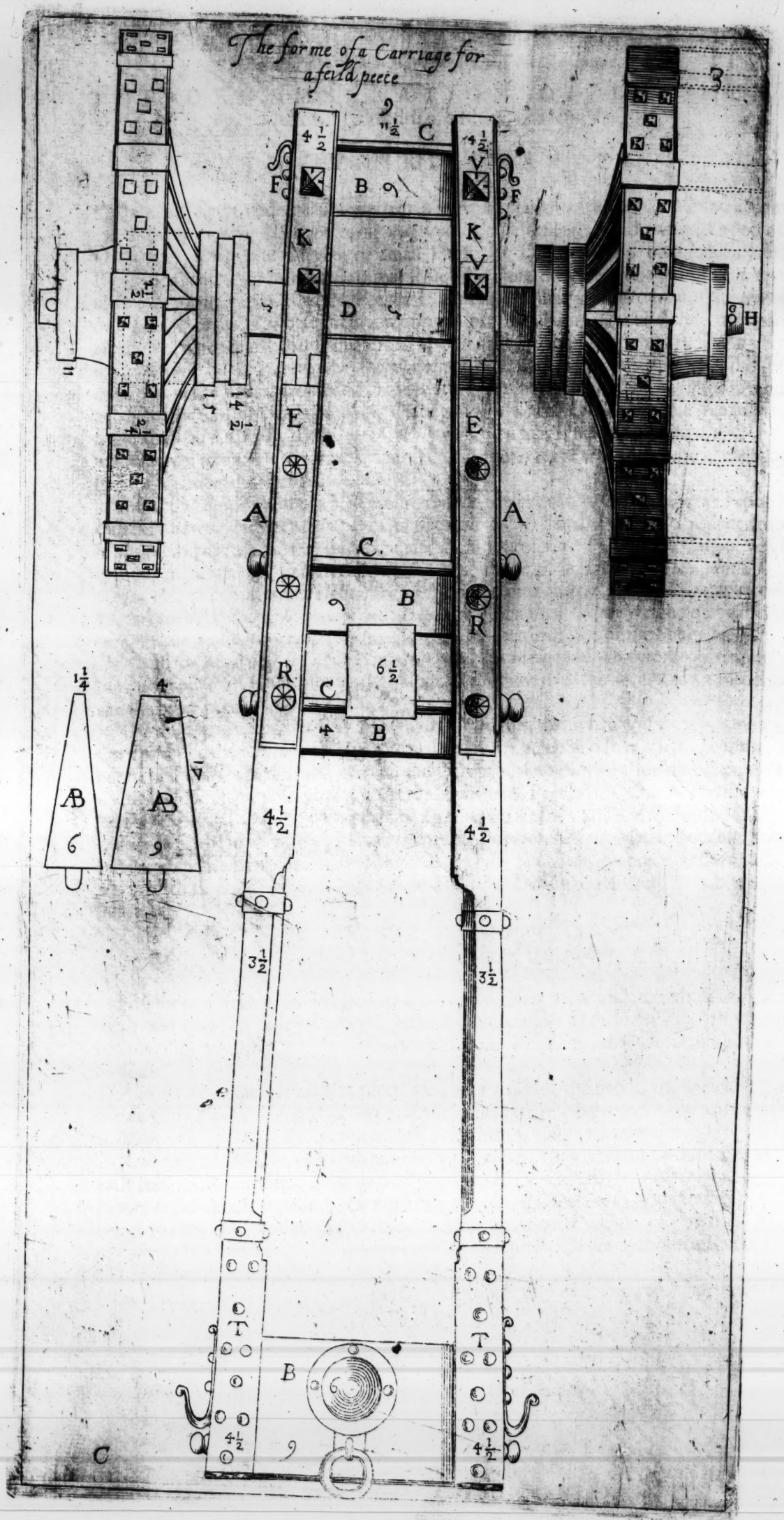


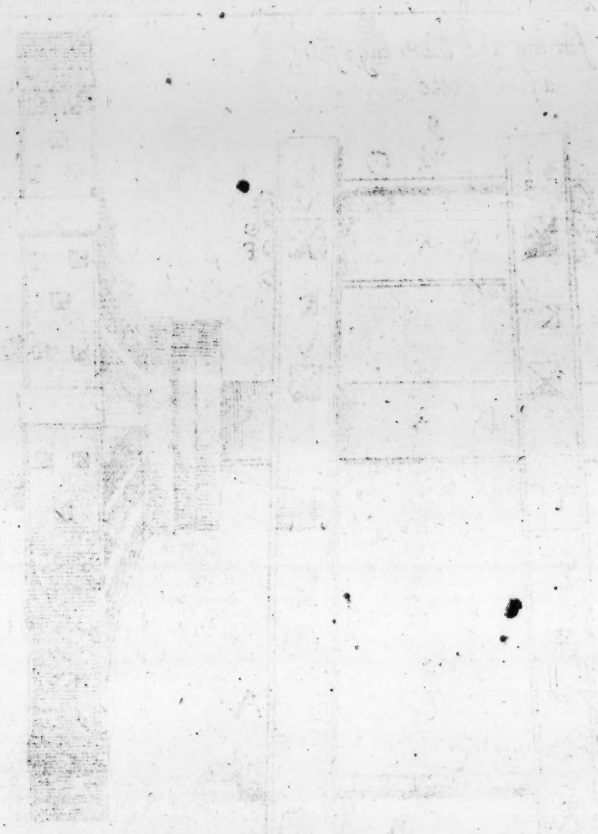
A halfe Canon Drake of 2250 lb. weight the length 7 foote

The Dyamiter of the bore is 6 ynches.



B


The forme of a Carriage for a field peece
A
B
C
D
E
F
H
K
R
V



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THE DEMOMSTRATION OF THE NEXT Figures following, and firſt of a Block, or a long Waggon:

THE THIRD CHAPTER

THe firſt figure underneath number 10. sheweth you of what ſingular uſe and accommodation your *Block*, or *Lisng waggon* o for the carriage, and drawing of a peece of Ordnance, or for the carrying of ſmall Punts, or Boats to clapp on a ſunden over a River, or a brooke, when occaſion may ſerue: therefore there is no one Inſtrument more uſefull for the traine of Ordnance then this is, and are excellent good alſo to ſtop an *Avenue* or a paſſage croſwiſe, where an Enemies horſe may breake in upon an Armie unawares, eſpecially, when one hath no time to caſt vp a trench, or a traverſe vpon it. Beſides, a peece of Canon will be eaſilyer drawne, through moorish, foule, and ſandie wayes vpon this, becauſe the peece lieth more ſteddie, and is not ſubject to ſo much wrenching aſide in durtie and Ruttie waies, then vpon its proper Carriage. Now whenſoever an Enemie should draw neere unto an Armie by the helpe of the *Fearne*, you may quickly hoize it vp, and laye it vpon its own carriage. The forme and moddle whereof is repreſented unto you in the figure following, noted number 10.

The ſecond figure number 11. demonſtrates to your eye a halfe Canon mounted vpon its carriage, drawne with ſeven couple of horſe, and a *Thiller* horſe, and this to be underſtood in a good way: but if the way be foule, morish, and durty, tnen for a whole Canon, weighing 7000. li. weight, you muſt ſpanne in 15. couple of horſe and a *Thiller*: for a *halfe cannon* eleuen couple and a *thiller*; for a feild peece or a quarter Canon ſix couple and a *Thiller*; for a *Falconet* two couple and a *thiller*; and for a ſmall *Drake* weighing 250. pound weight. one horſe. You muſt obſerue alſo that the mettle of one of the States half canons weigheth (as is ſaid before) 4500 pound weight, the carriage and yron worke thereunto belonging about 900. pound, ſo that theſe horſes are to draw in all the weight of 5400. pound, and the other peeces proportionably.

The third figure, number 12. repreſents unto you this, that when you want or cannot uſe Canon horſes and *Athrals*, how you may then by the helpe and ſtrength of men, drawe a peece of *Ordnance* to the topp of a hill, and there to make a *Platforme* for the battering of a Caſtle: Now preſuppoſe you are to batter it with 16. Peeces of Ordnance; to wit, eight *Demy canon*, and 8 *Quarter canon*, the firſt carrying a bullet of 24. li. and the ſecond of 12. li. and are to carry along with you all neceſſaries, as Powder, Bullets, Match, bedding, traces and diverſe other materials. The queſtion is how many Souldiers, Pyonniers, and workemen are able to doe this? which *Diego Vffano* in his 22. Dialogue reſolveth in this manner following.

Of a Block waggon, and drawing of Ordnance.

Firſt for 600. halfe Canon Bullets, each bullet weighing 24. pound, the whole weight of them will come to 144000. pound. Now if you lay three of theſe bullets, in a wheele-barrow, they will make 72. pound for every Souldier to wheele, and will require 200. men to doe it.

And for 600. quarter canon bullets, weighing 12. pound a peece, the weight of the whole will be 7200. li: now putting 7. of theſe into a wheele-barrow, for every mans share to driue, you muſt haue 86. men in all, and every man as before 72. pound weight.

Item for 168. weight of powder, for to charge theſe 16. peeces of Ordnance withall, each halfe canon requiring 12 pound of good powder for its charge, and for your quarter canon, or field peece 7. pound; you muſt have 240. ſmall firkins, or ſo many leather powder baggs to carry it in, and giving to euery Souldier 70. pound weight of powder, it will require the like number of 240. men to carry it, as is repreſented vnto you in the fourth plate and 12. figure following.

Now for the *Attelage* or drawing ropes for theſe 16 peeces of ordnance, repreſented vnto you

alſo in this fourth plate and 13. figure, is shown you the manner of it, by dividing your men into three drawing files or teames, according to the greatneſſe of the peece which your men are to draw up, for a Demy-canon, carriage, attelage, and all will weigh a matter of 6000. pound weight, now giving to every man 60. pound weight to draw ſuch a halfe Canon will require a 100. men to draw it, and proportionably the 8. half canons 800. men.

For a quarter Canon, carriage, attelage and all, will weigh 3000. pound weight, now allowing to every 60. pound weight to draw, every of theſe 8. peeces will require 43. men, ſo that for theſe 8. quarter Canons you muſt have in all 344. men, which being (as is ſaid) divided into three equall files and diſtances, each drawing rope muſt have 14. men and one odde man over to go by.

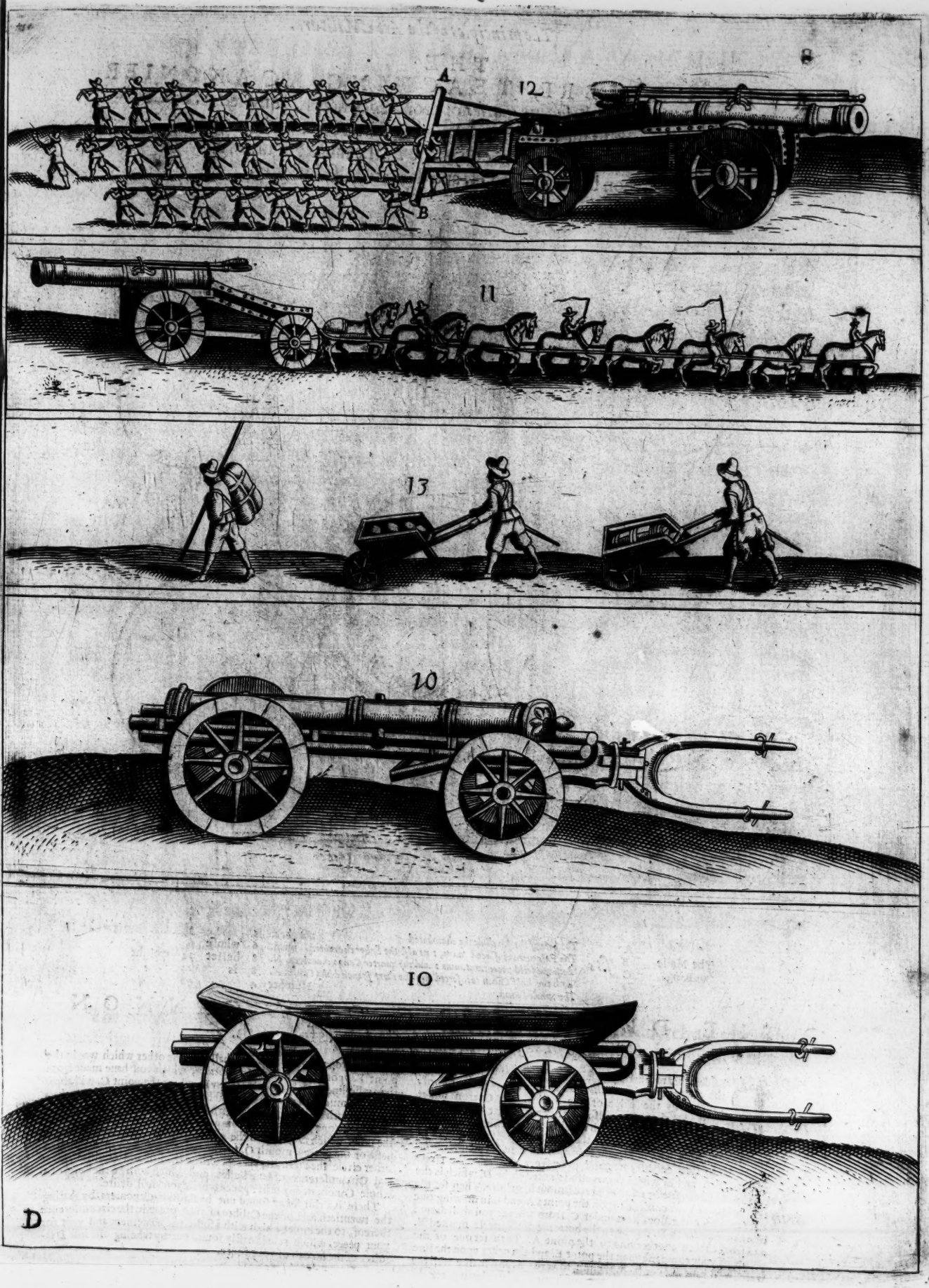
And becauſe it may ſometimes happen, that by reaſon of the ſteepineſſe, badneſſe, and unevenneſſe of the way, you may be driven to diſmount and remount your peece ere you get up to the top of the hill, you muſt carry along with you a *Fearne*, a *winch*, or a *Scalet*, with all appurtenances thereunto belonging, as winding roaps, an iron goats foot, with a crow, pinns, truckles, pullies to help you withall at a dead lift. All theſe Engines and Materials may conveniently be carryed on the shoulders of 30. men, inſomuch that if you make your calculation you shall find that you muſt have for the drawing of theſe 16. peeces of Ordnance, and for all things above ſpecified, the number of a 1703. men without any difficulty will do the deed and draw theſe Ordnance whitherſoever you pleaſe. The Fearn the figure and its neceſſaries shall be deſcribed unto you in the next chapter following.

Now for your attirals or drawing harneſſe, to the end that every man may draw alike share you muſt faſten a croſſebeame or barre to the end of the fore waggon marked as you ſee with *A. B.* through which you put your drawing roaps into an equall diſtance, that your men may not hinder one another drawing, having behind it three men to ſteer the peece aright, when you come to any winding or turning in the way.

Again, if it be a whole canon or a peece of Ordnance, which you are to draw through a trench to a battery, or ſome other place, where you would plant it, and find theſe drawing ropes to short for the men that are to draw it, then you muſt lengthen the ropes and faſten another croſſe barre juſt in the very midſt, and this will guide your peece from wrenching aſide for certain, the shorter your drawing ropes be, the more ſteddier and eaſier your peece willbe drawn, to every drawing rope alſo you muſt have as many necklines to caſt about your mens shoulders as you have men, to the end they may draw with more eaſe, ſtrength, and take firmer footing. Nevertheleſſe if you draw your peece after this manner up to ſome ſteepy hill leaſt the peece should fall downward and overturn them, for the avoiding of this danger, they muſt in an inſtant whip theſe lines over their heads to looſen themſelves from them, or elſe cut them on a ſuddain, but then it is ſafer to draw with their hands.

This manner of drawing of Ordnance is no new thing, but hath been practiſed by the firſt conquerours of the *Weſt Indies*, as *Pizarre*, *Ferdinand Cortes*, and diverſe others, who with the ſtrength of men drew their Ordnance over hils and mountains to the City of *Mexico*. Likewiſe *Henry* 4. King of France, of immortall memory, uſed this manner of drawing of his Ordnance over the Alphes in his laſt warres of *Burgundie*, and inſtead of pyoniers uſed luſty Swiſſers to do it

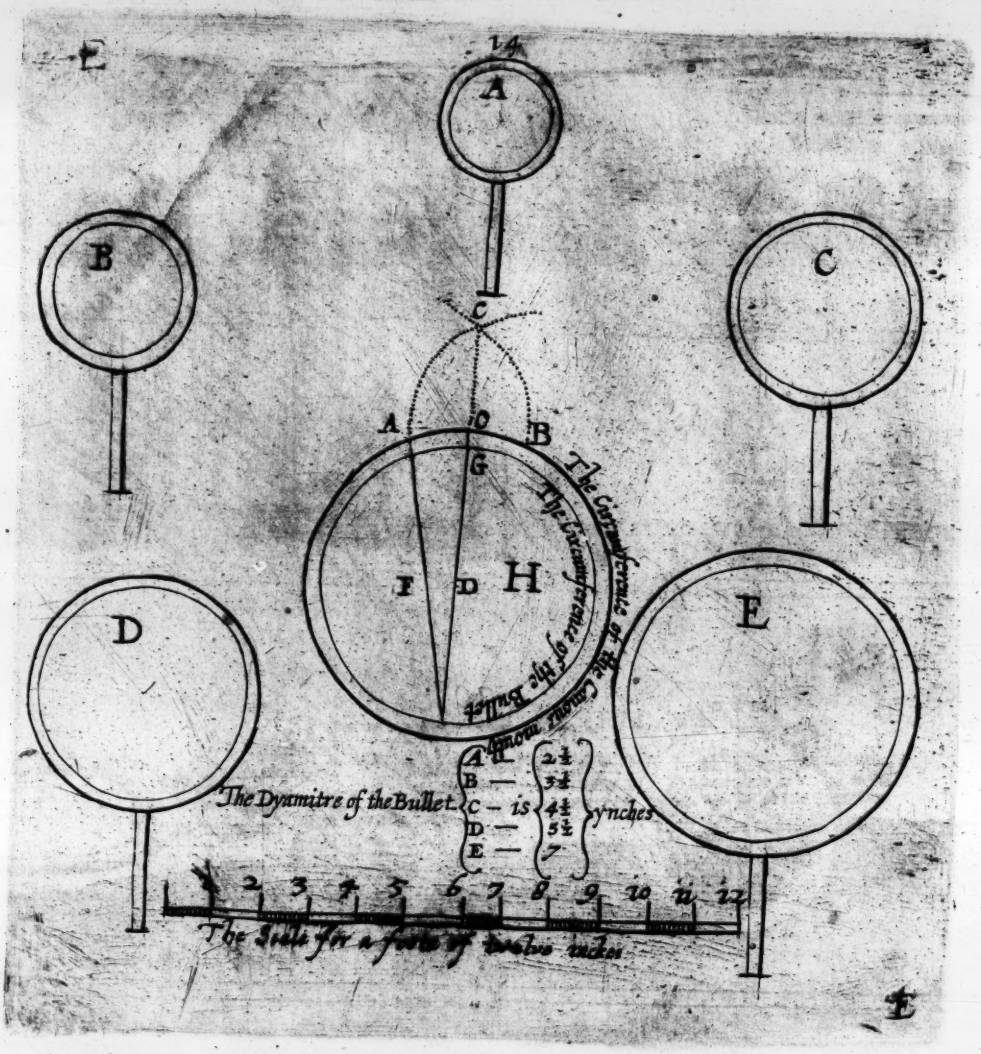
The 5. rings called in dutch, Mailles, number 14. is to try whether the bulleſs which you are to chooſe in the Arſenall will fall through them, which if they do, then they will fit your peece to a hair, the ſeverall bores and calibres of your 8. peece of Ordnance deſcribed before.



D

THE RVLE CALIBRE, TEACHING A CANONIER

How by the helpe of these fiue *mailes* or yron ringed hanels, numbred A. B. C. D. E. he may fit the *Calibres*, or Boores of these 8. seuerall peeces of Ordnance, figured out aboue, as also by the middle figure of a Canon bullet marked H. and decifered also by letter.



	A	*The bore of the small drake chambered*	number.	5		3		
The Maile	B	*The Falconet reinforced num, 1 as also the Saker chambred.*	num.	6	whose	6		
or Ring.	C	*fits* *Both the feild-peece reint. num 2 and the quarter Canon chambred.*	N.	8	bullet	12	weight	
	D	*Both the half Canon reinforced N. 3. the short french demy Canon.*	N.	8	is	24		
	E	is *The whole Canon.*	Number	4		48		

THE DECYFERING OF A CANNON Bullet, or any other peece by letters, as followeth.

BEsides this manner aboue said, by fitting your bullets out of the *Magazin*, for the *Calibres* and bores of any peece of ordnance, by the helpe of the mailes, the Caeron bullet marked H. shewes you also another way to fitt the *Calibre* of a peece of ordnance, with a right bullet, by giuing it the requisite vent. As for example, take the iust *Diamiter* of the mouth of your peece with a paire of straight *Compasses*, and then devide the *ouertur* thereof into two equall parts, and draw from the *Center* the circle marked B. A. and E. whose *Center* also is noted to be *D.* which is the forme and *Circumference* of your peeces mouth or bore, Then set the two points of your compasse vpon the points A. and B. in drawing one after another, the crosse- lines vnder C. from whence you shall draw a line *perpendicular* to D. downe to the bottome of the circle marked E. and from thence another line to the point A. Then set one of the points of your compasse vpon the point E. and the other vpon the line which you haue drawne from thence towards A. and marke well the point which the circle makes thereof from F. where letting rest the point of your Compasse, you shall raise the other which was in the point E. vpon the first line *perpendicular*, which you haue made from the crosse-line at C. by the Center to D. where the point C. will shew you how much lesse the bullet must be. Then the *Dyamiter* or *Calibre* of the mouth of your peece, for giuing it the necessary vent, so that putting the one point of your compasse upon the *center* D. and draw in the other which is sett vpon the edge of the *circumference* and Largenesse of the peeces mouth O. to the point G. and so in making an other circle the Dyamiter thereof will be the iust and requisite *calibre* and Circumference of your bullet, and which will fit the bore of a whole Canon, or any other peece which you shall desire.

There is a third way found out by skillfull Canoniers, by abating the twentieth part of the Calibre of your peece in the circumference thereof, to the bullet which with a sufficient abatement and vent for your peece, which rule is easily found out by takeing the iust Dyamiter of the mouth of your peece.

OF A FEARNE, A SCALET, AND A WINCH.

The Deſcription of a *Fearne*, called in French a *Guindall*, in Netherduch a *Bock*, from a Goate; with a *Scallet*, and a *Winch*, being of excellent uſe about the traine of Ordnance. Repreſented vnto you in the fifth plate, and 14. 15. and 16 figures following.

THE FOVRTH CHAPTER.

THe Carriage being placed in a readineſſe, you are then to hoiſe vp your peece into it, which in regard of the weight of it, be it a Canon, or any other great peece of Ordnance, cannot be well done without the ingenious helpe of the *Fearne*, or *Ghynne*, ropes, a Goats foote, or an yron Crow, leavers to winde vp the Rouler & c. eſpecially when a wheele is graveled and ſticks faſt in ſome deepe rutt, or rotten ground, then you muſt uſe the helpe of the Scalet or *Winch*; demonſtrated unto you in the figures following.

Firſt then you muſt make and frame your Fearne, according to this modell uſed in the States ſervice, which is accounted the beſt, number 14: and for the goodneſſe of it ought to be preferred before all others, and for the lightneſſe of it may vpon a march be layd vpon a waggon to be carryed along in the traine of the Ordnance with the Scalet, Winch, and all appurtenances thereunto belonging. It is made vpon three Feete, Beames, or Supporters, *triangular* wiſe, vpon which it ſtands. The demonſtration is this, *a.a.a.* are the three feete, which at the top or head of it are induſtriouſly joyned together; from *b.* to *c.* is the length of it, ſome 13 or 14 foote long: it is framed a foot broad, and halfe a foote thick; *d.* and *e.* showes a great yron bolt with a round head, and at the other end a croſſe wedge to clench and joyne it cloſſe together. *f. g.* is the Copper hoocke and ringe, vpon which the vppermoſt pullie or Truckle hangeth; *h.* the vppermoſt truckle it ſelfe, through which the ropes are let downe and wound vp: *i. i.* the cable or winding rope: *k.* the lower *truckle* above the Rouler: *l. l.* the Plate worke, within which the Rovler turnes in its bed, and ſcockets. *m.* is the Rouler it ſelfe. *n. n.* are the ends of the two ropes well pleated, and bound about, which are to be put through the eares of your peece which is to be hoiſed vp: *o. o.* the two oblique yron plated feete, vpon which it ſtands and reſts vpon the ground, and by reaſon they are ſo made, cannot ſo eaſily ſlip away, or ſinke into the Earth, but makes the Fearne to ſtand ſteadfaſt, and firme. *p.p.* are the holes into which the two woodden leavers are put into the Rouler and wound vp by two men, the one taking out his leaver to put it into an other hole, while the other with all his ſtrength holds the rouler faſt: *q.* are the two winding leavers. *r.* the Goats foote, or yron Crowe, neceſſary both for the Fearne, Scalet, and Winch. One of the winding ropes muſt be at leaſt 25 foote long, and in circumference a Geometricall ynch and $\frac{1}{2}$; the ends whereof muſt be ſo wreathed and bound faſt together that they muſt not looſen.

The maine rope muſt be 75 foot long, and 1 $\frac{3}{4}$ of a foote about; the ſlip muſt be well wrought and bound about with packthred, which is put through the two holes of the Rouler.

Of a Scalet.

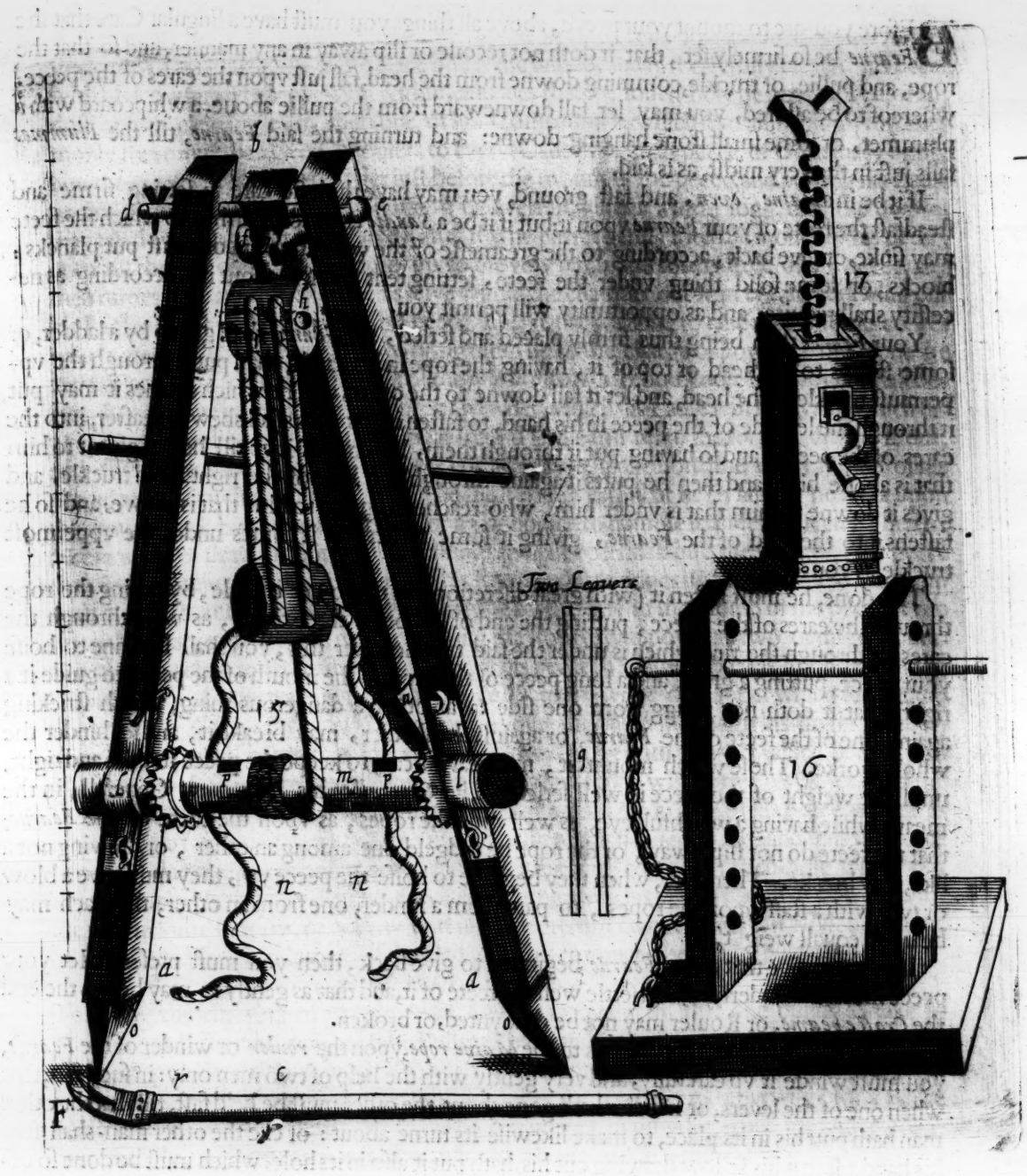
The other Engine is called in French a *Scalet*, or a Ladderet, in Netherduytch a *Knape*; which muſt have likewiſe a ſtrong yron Crow belonging to it, a thick oaken board, vpon which the pillers, or ſupporters of the weight ſtands, which are well nigh two foot long and a foot broad, and about halfe a foot in thickneſſe.

The two pillars of the Scalet muſt be enchaſed a quarter of a foot in the thick board, to giue it the more firmeneſſe, where vpon they ſtand, and muſt be a matter of two Geometricall foot high about the ſaid board, and $\frac{1}{2}$ and $\frac{1}{4}$ part of a foot thick, each pillar (as you ſee) having eight holes boored through them at an equall diſtance one from an other, thorow which you are to put

your great yron bolt, which with the yron crowe, muſt ſuſtaine and beare up the ponderoſity: unto this bolt there is an yron chaine faſtned to it, and nailed to the right hand pillar as you may marke: the bolt it ſelf ought to be 1 ½ of a Geometricall inch round, and 1 ½ of a foote long, each pillar muſt ſtand at leaſt halfe a foote one from an other. Vpon this yron bolt, which may be put into any of the holes as you raiſe vp the peece, and as occaſion ſerues, reſteth your yron crow and leavers, and receiveth ſtrength from it to lift vp your wheele peece, and all at a dead lift out of any rutt, moorish ground, or place when it ſticks faſt in it; and as you raiſe it, by this engine, you may clap thick fagots, or boards vnder the wheele, till you advance it higher to an other hole.

The *Winch* or *Windlace* repreſented here unto you in the 14 figure, is called in Netherduch a *Windaes*, or a *Dumcracht*, and is a differing Engine from the former, but of ſingular uſe alſo for the heaving vp of a peece of Ordnance, carriage, and all, let it be never ſo great, or any ponderous weight, as blocks, loggs &c. yea it is of ſuch great ſtrength and force that it is able to overturne a houſe, and hath no neede but of one man to put it a worke. Now to make it ſtronge and ſufficient, it muſt be two foote long at the leaſt, 1 ½ foote broade, and ½ foote, thicke, with a vice, and a teethed ſcrue comming out of the midſt of the woodworke of it, and winding up its teeth by the force of two ſecret wheeles turning within the midſt of the woodworke. This Engine may alſo be uſed (as the former) for the lifting up of a peece of ordnance out of a deepe rutt, morish ground, or any durt or mire into which it is ſunck; by laying of thick boards, and fagots vnder the wheele, as is ſaid; and this will be done quickly, ſo that you neede not looſe much time vpon a march: and thus much in briefe for the makeing and uſe of theſe three Inſtruments. The figures whereof follow in the next page.

Practi-


Two Levvers
15
16
17
F

HOW ONE IS TO MOVNT A PEECE VPON ITS CARRIAGE, by the helpe of a Fearne, or a Ghynne.

THE FIFTH CHAPTER.

BEfore you are to mount your peece, above all things you muſt have a ſingular Care that the *Fearne* be ſo firmely ſet, that it doth not recoile or ſlip away in any manner, and ſo that the rope, and pullie, or truckle, comming downe from the head, fall juſt vpon the eares of the peece; whereof to be aſſured, you may let fall downeward from the pullie aboue, a whipcoard with a plummet, or ſome ſmall ſtone hanging downe: and turning the ſaid *Fearne*, till the *Plummet* falls juſt in the very midſt, as is ſaid.

If it be in a *plaine*, *even*, and faſt ground, you may have the leſſe care in ſetting firme and ſteadfaſt the feete of your *Fearne* vpon it; but if it be a *Sandie* and a ſoft Earth, into which the feete may ſinke, or give back, according to the greatneſſe of the weight, then you muſt put plancks, blocks, or ſome ſolid thiug vnder the feete, ſetting tent pinnes about it, according as neceſſity ſhall require, and as opportunity will permit you.

Your *Fearne* then being thus firmly placed and ſetled, the *Gunner* ſhall get vp by a ladder, or ſome ſtepps to the head or top of it, having the rope in his hand, ſhall put it through the vppermuſt truckle of the head, and let it fall downe to the other, that he which catches it may put it through the left ſide of the peece in his hand, to faſten it, as wee ſhall ſhew hereafter, into the eares of the peece, and ſo having put it through them, he drawes it vp till he can give it to him that is aboue him, and then he putts it againe through the hole of the right hand truckle, and gives it downe to him that is vnder him, who reaches it againe to him that is above; and ſo he faſtens it to the head of the *Fearne*, giving it ſome turnes, till it comes under the vppermoſt truckle, as you ſee.

This done, he muſt faſten it (with great diſcretion) to the lower truckle, by puting the rope through the eares of the peece, putting the end of it thorow three times, as well through the eares, as through the ring which is under the ſaid truckle: after this, you ſhall beginne to hoiſe your peece, putting a great, and a long peece of timber into the mouth of the peece to guide it a right, that it doth not ſwagg from one ſide to an other; a dangerous thing, which ſtricking againſt one of the feete of the *Fearne*, or againſt the Rouler, may breake it, and ſo hinder the whole worke. Thoſe which mounts it, muſt have a care to keepe the peece ſteddie and right, untill the weight of the peece is well ſetled. The *Generall* or his *Lieutenant* Generall, in the meane while having a watchfull eye, as well vpon the ropes, as vpon the feete of the *Fearne*; that the feete do not ſlip away, or the rope be cadgeld one among an other, or drawing not a like, may breake. Therefore, when they beginne to hoiſe the peece vp, they muſt give a blow or two with a ſtaff vpon the ropes, to part them a ſunder, one from an other, that each may beare an equall weig' t.

If you perceive that your *Fearne* beginnes to give back, then you muſt preſently let your peece ſinke, and uuderlaye, and ſettle well the feete of it, and that as gently as may be, to the end the *Croſſe beame*, or Rouler may not be diſioynted, or broken.

Finally, giving two or three turnes to the *Maine rope*, vpon the *rouler* or winder of the *Fearne*, you muſt winde it vp carefully, and very gently with the help of two men only: in ſuch ſort, that when one of the levers, or handles hath gone about, the other muſt be held faſt, till that the other man hath putt his in its place, to make likewiſe its turne about: or elſe the other man ſhall ſtay his hand, till that his fellow drawing out his, hath put it alſo in its hole; which muſt be done ſo often, till the peece be hoiſed ſo high, that you may put your Carriage vnder it.

Alſo you muſt take heede that your peece knocketh not againſt any part of your *Fearne*, which might cauſe any *diſaſter*, or that the *Fearne* might breake, and letting the peece fall, a miſchiefe may happen, and put all into diſorder: wherefore you muſt put the carriage under it very gently, that the *Tronions* may fall juſt into the holes or claſping ſockets of the carriage, and ſo guide your peece by the beame which it hath in its mouth, that it falls ſoftly to reſt upon its carriage, and then locking it well in, and faſtning it with the wedges, you may then looſen your ropes, and taking away the *Fearne*, your peece being thus mounted you may draw it whitherſoever you pleaſe.

Practi-

HOW A CANONIER OUGHT TO CHARGE A PEECE.

CHAPTER VI.

A Peece being brought to a *Batterie*, and planted upon a *Platforme*, having powder, bullets, his linſtock, ſcowrers, Rammers, and all things elſe in a readineſſe, after he hath ſtuck down his linſtock in ſome place under the winde, and firſt carefully cleared his peece with his ſcowrer and sheepe-skin within, and ſees that the touch-hole be not ſtopped, or any duſt or filth cleaving to it, then one of his Companions, which is to aſſiſt him, (for commonly there muſt bee two Canoniers to every Canon, or great peece of Ordnance) brings him the *pouch barrell*, with powder iuſt before the mouth of the peeee, and putting his Ladle or charger into it, fils it, and leaſt it might be overfull, giues it a little iogg, that the *Surplus* may fall down againe into the barrell, after this he puts it gently into the mouth of his peece, even till the end of his Ladle comes up to the very brich and touch-hole of his peece, and then turnes his Ladle ſoftly, and lets it lye within the chamber of the peece, and drawing out his Ladle almoſt to the mouth of his peece, puts it back againe to take up the looſe cornes which were ſpilt by the way, and to bring them up to the charge of powder: this done he drawes out his Ladle, and takes out of the *pouch-barrell* a ſecond Ladle full (for by triall before, he knowes the weight and charge of powder, which his Ladle will hold, and which his peece well require) and ſo putting in his ſecond Ladle full up to the former, drawes it out, and doth as he did before, that no looſe cornes may lie in the bottome of the mould of his peece, and in drawing out of his Ladle, he muſt haue a care, that he let fall any powder upon the ground, for it is a thing unſeemely for a Cannonier, to trample it under his feete. Then he takes a wiſpe of ſtraw, hay, or any other thing: and puts it ſo hard into the mouth of the peece (turning his ladle to come to the end of his Rammer) hee driues up the wiſpe and carries up with it the looſe cornes, which happily may be by the way in the mould of the peece, even up to the charge of powder, and then giving the ſtopper and powder, two or three shoues, to make it lie cloſe together in the chamber of his peece, he drawes out his Rammer, puts in his bullet, which roules gently into his peece up to the wiſpe or ſtopper which keepes up the powder (all this while his *Companion* ſtopping the *touch-hole* with his finger, that no powder flies out of it, but that it be alſo well fild and ſtopt with powder which hee may do out of his *touch-horne* afterwards) and then puts in his ſecond wiſpe after his bullet. And the Canonier is to be forwarned, that he ſtands not iuſt before the mouth of his peece, while this is a doing, but aſide of it, leaſt a danger or miſchelfe might happen to him, and thus the peece having its due charge both of powder and bullet, he ſhall cover his touch-hole with a dry sheepskin, after he hath levelled his peece, and ſetting away his pouch barrell of powder with the reſt, in ſome *Concaue*, or hollow hutt into the ground covered over with ſodds or earth, he ſhall attend the Gentlemans of the Ordnance his command before he giues fire.

An other obſervation for a Canonier.

Touching the charging of a peece *Frons-berghen* maintaineth, that one ought to take in powder one half of the weight of the Bullet. Rivius and ſome others are of the opinion, that the more powder one puts in, the ſwifter and further the bullet wil fly shewing many reaſons to proue it. But experience the miſtris of this Art teacheth us otherwiſe: for a peece being loaded with two third parts of the bullets weight in powder, ſends the bullet going more ſwiftly, and will carry it further, which hath bin ſo often tryed, that it is without all contradiction, giving this reaſon, that the *exhencia* is ſo ſwift and violent, that it burſteth out of the mould before the two third parts of the powder be fired, and this hath beene found irrefutable.

Again others maintain, that if one ſhould forcibly ramme in the bullet then the powder might take fire, ere it could caſt out the bullet, and then would cauſe the bullet to fly further then otherwiſe it would do, but you muſt conſider in ſo doing, you either indanger the breaking of your peece, or elſe make it crooked and unſerviceable, becauſe your ordinary peeces will not bear ſo great a charg of powder, this hath bin tryed upon the Sea ſtrand at Scheve-

ling by the Hagh in Holland, before his Excellency prince Maurice of famous memory, where first one and the same peece was loaded with ten pound of fine powder to see how far she would carry her bullet. The place being marked where the bullet rested, shee was loaden again with 9. pounds, which shot as far as the ten pound did, but last of all shee was charged but with 7. pounds of the same powder, which carried her bullet further then the two former shots: whence one may obserue, that a peece of Ordnance may be overcharged, and therefore a good Gunner ought to haue a singular care to giue his peece her due measure and charge.

Of the Gunners service in generall.

NOw forasmuch as Ordnance are Engins of force, reason, waight, and measure: and the Gunners men exercised and experienced in them and their apurtenances, in making platforms with defences, Troniers, Gabbions, Loopes, Parapets of earth, and Faggots about 23. or 24. foot high, of Faggots of 2. foot high of earth, bed upon bed vnto eleven foot high, and after 3. foot of Terraplene, to raise the Troniers and Loopes, so that for the Canon it be 3. foot wide in the Barb and within 12. foot wide without the lower part therof to descend scarpwise the better to discover the Enemies avenews, and offend them the more freely, for avoyding the blast and smoake, and ruine, it would else make: For the Culverings 2 foot and a halfe within, and 9 foot without will suffice, and for lesse peeces, lesse measures. If the Battery be to be made with Gabbions, they being filled with earth without stones, moistned, and rammed 7. foot a peece in dyametre, 3. rankes betwen 2. peeces, if the place will permit or 2. at the least, and 3. rowes also one before another, setting one betwen two, so if the 1. ranke haue 3. the second will haue two, and the third one, but it will be hard to make a safe Battery with Gabbions, Canon, or Culvering proofe: And each platforme is to haue 30. foot for the reverse of the Canon, and 27. foot for the Demy Canon, he ought to see that it be levelled, or rising 1. foot for 20. backwards the better to stay the reverse and facility, the bringing the peece being loaded to the Loop: He ought to search and examine, the goodnesse of the peeces, their Ladels, Rammers Spunges and Tampion, fitnesse and roundnesse of the shot, force and goodnesse of the powder and match; And to see all fitted accordingly, and to place the powder covertly, hid safe from the fire of his owne as also of the Enemies Ordnance, to see the Gunners take their markes toward the under part, giving each under Gunner his charge.

HOW A CANNONIER OVGHT TO LAY AND Levell his Peece and to amend a bad shott,

CHAPTER VII.

HAving time and Command to lay and Levell a Peece, according to the ordinary ayme, to try how farr it will carry, the *Canonier* shall take a long ruler, and laying it vpon the midſt of the *Frizes*, aſwell of the brich, as of the *muzzle* of the peece, and a levell upon it, he shall raiſe or ſinke it, untill the plummet of the Levell be iuſt in the midſt: then taking away both the Ruler and the Levell, he shall ſee even with the Frizes, the point or marke which this ayme diſcovers, which without doubt will be the place it wil carry to; with which according to the levell of the mettell, whereof wee will ſpeake hereafter, it will make but the half. But if he hath no leiſure ſo to uſe the *Ruler* and *Levell*, he may take his ayme, or lay his peece, as he finds good, according to the charge and proportion of his peece. If he ſtrickes his marke, he may then be aſſured, that his ayme is right, and uſing the like weight of powder, will alwaies make the ſame shot.

But if his bullet carries over, he shall level his peece againe as he did before, and having got the firſt marke in his ſight, he shall neither ſtirre nor mooue his peece: but shall take away aſmuch of the *Frizes* of the brich, till he ſees the blow which the bullet gaue, and which will bee the true, and right ſight, which he preſently may trie by laying his peece upon his firſt marke, which without any doubt he will ſtrike.

Now if his firſt shot fals short, then he muſt doe as he did before, levelling his peece again and then without mooving it, he shall goe and take away the *Frizes* from the *muzzle* till hee diſcovers the blow of the bullet, and then he shall haue the true ſight; according to which, laying his peece upon the firſt marke, hee will ſurely ſtrike it, if that there bee no fault in the powder.

There is an other way of levelling of a peece, and amending of a bad shott, in adding or diminishing the elevation, according to diſcretion. To witt, when he shootes short of his mark, the peece is remooved and layd as before, afterward he raiſes up the *Muzzle* as he shall judg, and as need shall require, that he may ſtrike his deſired mark, obſerving well alwaies how much this elevation is made higher then his firſt ayme taken, which he shall perceiue if looking even with the mettell, he shall ſee what marke it will show him.

How a Canonier ought to Levell his Peece.

Then giving fire, and ſtriking the marke before aymed at, he may be aſſured, that his peece carries right, to which henceforward hee shall giue as much height aboue the naturall Levell: if it failes, that is, if he over shootes his marke, let him diſpart that which his firſtshot fell too short, with the length of the ſame, for the leſſening of the Elevation proportionably; in doing whereof, without all queſtion hee shall ſee his shott remedied, and a right shott made. And this is your common and ordinary way in which Gunners do moſt exerciſe themſelues in, with aſſurance that he which knowes not by this meanes to giue the right elevation and range to his peece, is not worthy of the name of a *Canonier*. Now for his better underſtanding I will giue him this example.

Suppoſe a *canon* be mounted upon his carriage, and planted upon a *plateforme*, and is to mark a shot at ſome *white-ſtone* or marke in a Wall. To doe this, your Gunner muſt take his ayme as curiouſly as poſſibly he can Levell with the mettell of his peece, but if his shot fals to short, to helpe it he shall take his ayme againe, and shall lay his peece as hath beene taught before: afterward he ſhall raiſe it a point higher, ſo that whereas he had but 6. before, now he hath 7. points of the elevation, and afterward giues fire. If he ſtriks his mark let him alwaies take the ſame ayme and Levell, But if he over shootes his marke, let him levell his peece as is taught before: by diſparting the difference of the firſt, from 6. with that of ſeven points, as diſcretion shall guide him, according to the carriage of the firſt shot, and giving fire, (without all doubt) he shall hit his deſired marke. And his Peece being thus raiſed he muſt keep in his ſight the point or marke which is showne him, and obſerue wel the height which is aboue his marke, with aſſurance that when he is to make more shot by keeping this elevation he wil never faile. But if the firſt shot lying upon the 6. points be to high, then he shall helpe that by the ſame Rule in laying his peece lower, and ſo shall ſtrike his marke whereby he shall get credit and commendations for it.

A new deviſe by any ſtaffe, to levell, mount, and imbaſe any peece.

ALſo any peece may with a field Linſtock, Rammer, or Spunge, or other ſtaffe be mounted to any degree of the Quadrant, being thus prepared, firſt mark from one end of that ſtaffe a diſtance equal unto the height of the pomel or caskabel of the peece, placed levell upon her platform, & then take the diſtance between the centre of the Tronions, and the pomell or caskabell, which make or imagine a ſemidiametre of a Circle, and divide it by diagonals or paralels, or otherwiſe into a 1000. equal parts. Laſtly out of the table of Sines, take the number anſwering to every degree out of the ſaid 1000. parts, and ſet that diſtance from the ſaid mark downwards, and if the totall Syne of the table be 100000. omit the two laſt figures of each number thereof toward the right hand, and if it be 10000000. then omit 4. figures of each number you find in that Table, and the remaining number will ſhew how many of thoſe 1000. equall parts are to be ſet downwards from the mark beneath the ſaid levell for each ſeverall degree: Then drawing alſo 10. paralels or diagonals from the firſt degree to the ſecond, and from the ſecond to the third, &c. ſucceſſively continued from each to his next, noting every degree with Arithmeticall characters, ſo you may from ſix minutes to ſix minutes by thoſe right ſignes mount the peece, ſo ſet forth for any peece which it ſhalbe prepared for. This may alſo be deſcribed upon ſuch a ſtaffe without the table of ſynes in a mechanical manner thus, If you deſcribe a Quadrant or quarter of a circle with a ſemidiametre, equall to the diſtance from the centre of the trunions, to the centre of the pomel or caskabel, & devide the Arch of that quadrant into 90. equall parts or degrees, and then from each degree letting a line fall perpendicularly upon the baſe ſide of the ſaid quadrant, and laſtly, each of thoſe right lines being thence transferred from the ſaid firſt marke downwards upon the ſaid ſtaffe, and marking them with arithmeticall figures for each degree, thereupon making alſo paralels and Diagonals as aforeſaid, you may thereby Geometrically and mechanically marke the ſame from 6. to 6. minutes as before. The uſe of them is plain and eaſie, for if you bring downe the centre of the caskabel or pomel of the peece to any number of the degrees thereon ſo marked, for that peece, you ſetting the lower end of the ſtaffe to the platform being even, although it be riſing or deſcending backwards, I ſay then the axis of the bore of that peece wilbe found to be elevated to the degree aſſigned: If you be to imbaſe the peece, thoſe lines and number alſo ſet above the firſt named mark, will perform the like office there, in the thing required.

OF A QVADRANT LEVELL, AND OTHER Inſtruments for Ordnance, and the uſe of them

The forme, proportion, and making of a quadrant and a Levell, with an inſtrument to ſhew the uſe of it, is very neceſſary for maſter-Gunners; *and* Canoniers, *for the Levelling and ayming of Canon, other Ordnance, and Morters demonſtrated in the fift plate, and 15. 16. and 17 figures following.*

CHAPTER VIII.

TO make a *quadrant*, as is fitting, one muſt firſt make the whole circle marked 1. which is devided by lines, running from its *center* into 48 equall parts; at the end of each is noted the number thereof, incloſed in a ſpace between two little lines within an other circle, and between two *Vergets* or ſmall *rings*, where you ſee there is a ſpace alſo, by which the ſaid line is devided equally in the midſt.

With a quarter of this circle is made your *Quadrant* marked (2) being from *l* devided into twelue points, making ſeven degrees and a halfe, ſo that in all they make 90, which is iuſt the fourth part of the 360 degrees of the whole circumference of the world.

It may alſo be devided, as you ſee upon the white, each one the outſide, into 45 points, wherof every of them make 8 degrees: ſo that the whole 360 degres are comprehended within them, according to this *form* and deviſion is made your other *quadrant*, noted (3) and is marked with, *A. B.* and *C.* devided into 9 equall parts, each of them making 10 degrees.

Now by theſe two *quadrant*, the plummet hanging in the midſt from the point of the 45 degree, which are alſo devided into two equall parts, is showne to you the higheſt elevation and range of a peece, yea as ever the peece is able to carry at length, as you may ſee in the figrues following of a Canon and a Culvering.

The like is alſo showne you by the *Levell* marked (4) for the ayming, and levelling of peeces, when you are to take your maike aright, which alſo is uſefull for the making of your *platformes*, and beddings for Ordnance, all which are neceſſarie for the Art of Gunnerie.

This may alſo be made by a *quart* of the former Circle, if you devide it into 12 equall points, and ſo noted and ordered, that you muſt beginn to count from the midſt of it, towards the ends or ſides to the 6 point, ſo that your *plummet*, being upon the 6 point iuſt as the others, you ſhall, finde that your peece is layd at its higheſt elevation and range.

The *Cartabon* (or your foureſquare levell) marked 5, comprehends alſo all the circle abouesaid, and is devided into 48 pointes, according to the foure quarters of the world, that is, *Eaſt, South, North, and Weſt*, making alſo foure particular *Quadrants*, whereof the forked dart comming from the center or midſt; showes all the lines, not onely of the *Circle*, but alſo of the *Quadrant*, or your foure ſquare levell, and running in a line from the midſt, marked with O and N or with O and S, it will make a *Levell*, and is in the firſt degree of the right *Quadrant*, but comming from the midſt, and betweene the ſaid lines, it will shew you your higheſt elevation, as the other Quadrants haue done. The handle noted *E. F.* (if it be poſſible) muſt be 2 foote and a halfe long, whereof each foote muſt be 16 ynches, to the end it may make iuſt 40 inches, that in 3 foote and foure inches of our ordinary foote, which is an ordinary pace, or halfe a Geometricall one.

Of a Quadrant Levell, and the uſe of them.

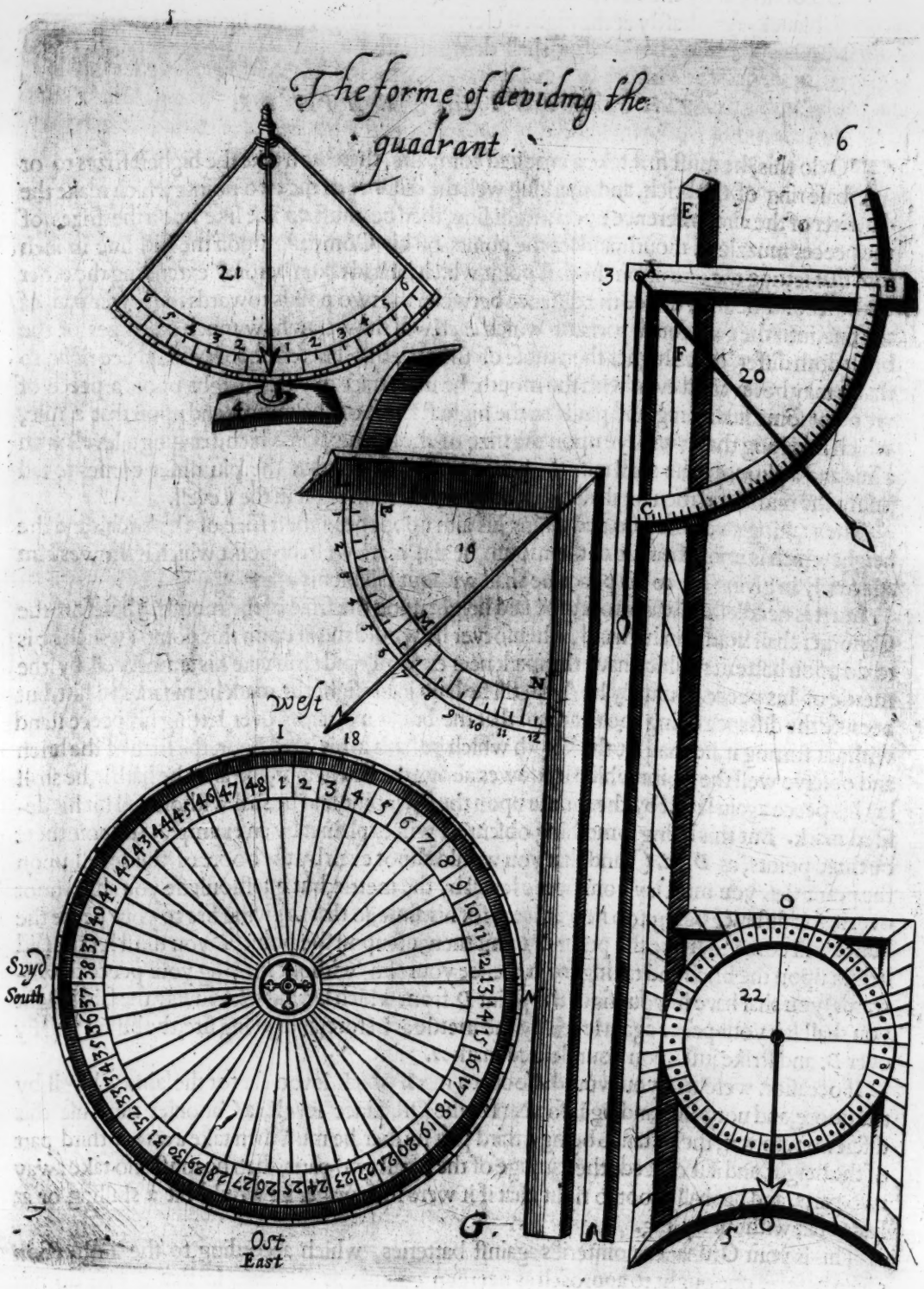
Each of theſe ought to haue in the midſt, and at the end a little hole going from the one ſide of the handle to the other, which ſerue for this uſe, that this inſtrument being ſet upon the brich of your peece, looking through one of them aboue the higheſt *Frizes*: you may giue a shreud geſſe how farre your peece will carry the bullet, according to the length, condition, and proportion thereof. The two pins which you ſee on the ſides of it, marked C F ſerue to this end, that thereby you may diſcerne the quality of the place, which you would meaſure, the point deſſigning by its fall from the Eaſt towards the North, the length, bredth depth, and height of the ſame. Finally this inſtrument contayneth many miſteries of great conſequence, and is of excellent uſe both for an *Jnginer*, and a *Canonier*.

The common rule, whereby a *Canonier* may know how farre his peece will carrie, and how farre from one degree to an other, according to the *elevation* thereof, let him firſt ſee how many

paces it will carry being laid even with the mettle, which afterward he shall devide by 50. and multiply the Quotient by 11. and that will bring out the number of the further digreſſion or range, which if he devides again by 44. he shall then find the quotient to be the juſt number of paces which the bullet will looſe in the other ranges, degree by degree, as for example A battering Canon will shoot its bullet being laid even with the mettle a thouſand ordinarie paces, at two foot and a half the pace, which being devided by 50. your quotient will give 20 which being multiplyed again by 11. it will give 220. paces, which is the number of the next digreſſion, made in the ſecond degree of the quadrant, or the firſt after the Levell aboveſaid.

But all the other digreſſions or ranges, do alwaies diminish even unto the 45. degree. To know then what this diminishing is from degree to degree, even unto the 45. which is the higheſt elevation, you muſt take the juſt number of the digreſſions from the firſt to the 45. which will be 44. now deviding them by the former number of 220. paces, you shall find your quotient to be 5. which is the number which goes alwaies, decreaſing from the firſt to the laſt digreſſion, ſo that your Canon being laid upon its naturall mark, in which it is raiſed a degree above the Levell, even with the mettle, making a 1000. paces as is ſaid, being laid upon the ſecond degree, adding 220. paces to it as an advantage, then it will carry the bullet 1220. paces before it ſtops. Again, you may add the ſame to the third degree, but the former being the greateſt digreſſion, as we have taught, this then, and all the others will alwaies diminish 5. paces, and will make but 215. above the 1220. of the ſecond degree, ſo that you shal have in your third degree 1435. paces. in the fourth degree 1645. in the fift degree 1850 paces, in the ſixt 2050. paces, in the ſeventh, 2245. paces, in the eighth, 2435. in the ninth 2620. paces, in the tenth degree which is the firſt of the quadrant of 9. points, it will be 2800. paces, in the eleventh, 2975. in the twelft, 3145. in the thirteenth, 3310. in the fourteenth, 3470. paces, in the fifteenth, 3657. in the ſixteenth, 3775. in the ſeventeenth, 3920. in the eighteenth 4060. in the nineteenth 4595. in the twentieth degree, which is the firſt of the ſecond point, 4325. paces, in the one and twentieth, 4450. in the two and twentieth, 4570. in the three and twentieth, 4685. in the twenty fourth, 4795. in the twenty fift, 4900. in the twenty ſixt, 5000. in the twenty ſeventh, 5095. in the twenty eight, 5185. in the twenty ninth 5270. paces, in the thirtieth which is the beginning of the third point, 5350. paces, In the thirty one, 5425. paces, in the two and thirty, 5595. in the three and thirty, 5560. in the four and thirty, 5620. in the five and thirty, 5675. in the ſix and thirty, 5725. in the ſeven and thirty 5770. in the eight and thirty, 5810. and in the nine and thirty degree, 5945. paces, in the forty point which is the beginning of the fourth point, 5875. in the 41. 5900. in the 42. 5920. in the 43. 5935. in 44. 5945. Laſtly in the 45. when you reckon but foure halfe points of the quadrant, you have the higheſt elevation or range, as you shall ſee in the figure following, which maketh 5950 paces.

To conclude, a skilfull Canonier exerciſing himſelf herein, will eaſily conceive and know certainly how to levell his peece upon any one of theſe degrees and points, and how farre it will carry, be it great or little: for this calculation will never fail him, by obſerving this, that in giving the chaſe or elevation of his peece, in what point ſoever it be of this rule or degree reaches from 1. inch to 16. which is a Geometricall foot. *The next chapter following shall shew you the uſe of it in levelling of Ordnance after three manner of wayes, to wit, even or levell with the mettle, point-blanke, or upon a higher elevation at a range.*


The forme of devidmg the quadrant.
6
E
3
B
F
20
C
21
19
M
N
west
I
18
Syyd
South
Ost
East
G.
O
22
O
5

SHOWING HOW A CANNONIER SHALL Shoot levell by the mettle of his peece, otherwiſe called the *Horiozontall Levell.* Secondly, or by the *Levell Axis* vulgarly called by ſome Gunners the levell point blanck. And Laſtly at the higheſt elevation and range, as the figure following ſhall demonſtrate.

THE NINTH CHAPTER.

TO do this, he muſt firſt take a crooked compaſſe, therewith take the higheſt frizes to or baſe ring of the brich, and marking well the diſtance of the two points which make the diamiter of the circumference upon a right line, then he muſt do the like upon the frizes of the peeces muzzle or mouth, and ſet the points of his Compaſſe upon the ſaid line in ſuch ſort, that ſetting the one upon the firſt point which he had taken before, extending the other to the ſecond, he ſhall divide the diſtance between the two points towards the lower part of the line, into the two equall parts, of which each will ſhow him how much the frizes of the brich doth differ, or are higher then thoſe of the mouth. Therefore to lay his peece right, ſo that it may be levelled even with the mouth, he muſt trace out this height upon a peece of wood or ſome ſuch thing, and put it to the higheſt frizes of the mouth, and upon that a rule, which is ſo long that it will lye upon the frize of the brich, upon which, hanging a levell with a line and a plummet, he ſhall raiſe the peece or ſinck it, till that the plummet comes to fall juſt in the midſt, and then he ſhall have the boore thereof, right in the Levell.

Then taking away the rule, and taking his aim upon the higheſt frize of the brich, and the height which is upon the frize of the mouth, he ſhal mark well the point which it ſhowes him and ſurely in giving fire to his peece he ſhall without fail hit his mark.

But it is needleſſe alwaies to ſet the ſaid height upon the frize of the mouth, therefore the Canonier ſhall hold it in his hand, whenſoever he would ſhoot upon this point (which he is to do upon batteries, which have the mark neer enough) and ſhall take his aime levell by the mettle of his peece, as uſually he doth, till he hath in his ſight the mark he meanes to hitt, but becauſe the diſtance being too near, and that the bullet may carry over, letting his peece ſtand without ſtirring it, he ſhall ſet the heigth which he hath in his hand upon the frize of the brich and obſerve well the point which it ſhowes above the ſaid height, and after he hath it, he ſhall lay his peece again levell by the mettle upon the ſaid point, and he ſhal without fail hit his deſired mark. But this being ſomething obſcure, I will explain it by an example, Suppoſe there be three points, as *D. A. C.* and that you would ſhoot even by the boore of the levell upon the point *A.* you muſt lay your peece levell by the mettle, but queſtionleſſe you ſhall ſhoot over it, the diſtance being too near at hand for his aime, ſo that in giving fire to your peece the bullet will come to ſtrike the point *C.* to hit then juſt upon the point *A.* you muſt ſet the ſaid height upon the brich and taking from thence your aim (without moving your peece downwards) you ſhal have in your ſight the point *D.* from which having taken away the ſaid height you ſhall lay your peece again levell by the mettle as before, and giving fire, the bullet will fly over *D.* and ſtrike juſt upon your deſired mark *A.*

If occaſion were that you would ſhoot at a mark which is too far for the aime, levell by the boore, and notwithſtanding is ſo neer for the Ordnance levell, a Canonier muſt uſe this diſcretion, to wit, the diſtance being a third part further, he muſt then take away a third part of the height, and if it exceeds the carriage of the levell two parts, then he muſt alſo take away two parts, and he ſhall ſhoot ſo right, that if it were for a wager he would hit a ſhilling or at leaſt a hat without fayling.

This is your Ordnance pointeries againſt batteries, which according to the inſtruction given before, one ought to approach as neere an enemie as one can, ſo that if you do not take

take heed to lay alwaies this heigth upon the brich of your peece, you will alwaies ouer-shoot your mark, contrary to the deſire of a good Canonier, which is alwaies to beat upon the foot or foundation of a wall, that it may tumble down, and be battered the ſooner, for the eaſier entrance of a breach, obſerving that it is one of the principalleſt conſiderations in all shoots, that in making a good shot one levels his peece at the foot of his mark, eſpecially in shooting at a troup of horſe, or a company of foot. But in a ſtony place, a Canonier doth willingly shoot short, becauſe in ſtriking upon the ſtones or bricks, in razing them, he makes a hole much greater then the bullet which goeth through them. But in a plaine place one muſt lay his peece ſo, as the bullet may take them iuſt in the middle, or about the girdle, and ſo may kill a whole file, or a rank at a shot, yea though they should all fall flat down upon the ground, yet they cannot all eſcape, otherwiſe if you levell too high, it may be accounted but as a loſt shot. To amend then a shot too high for this mark, you muſt levell your peece upon the white or marke you shoot at, then going to the mouth of your peece with a levell line and a plummet, and take there the height of the higheſt frize or ring to the bottome of the boore, which you shall ſet to the frize of the brich, and from thence, and aboue the frize of the mouth, you shall take (without ſtirring the peece) your aime, marking well the place it will shew you, then taking away the ſaid heigth, you shall lay your peece againe upon the point it showed you, and ſo without fayling, you shall hitt the mark you deſired. But if you peece carries to short, it muſt be amended in this manner, lay the peece as before, then going to the mouth with your line and plummet, take all the heigth of the frize from the top to the bottome, in ſuch ſort, that your line may take the whole Dyamiter of all the circumference thereof, and by this dyamiter, you shall take the thickneſſe of the mettle from the bottome of the boore, even to the loweſt part of the ſaid frize, and laying this heigth upon the brich of the peece, and levelling it upon the mark deſſigned, which you would shoot at, you shall ſee the good effect it will take: now for a shot that is made on either ſide of your mark, it is to be helpt in this manner following, if the bullet fals on the right ſide of it, then you muſt lay or mooue your peece, and take your aime ſo much on the left hand, and that you may not faile a hairesbreadth, now to make the diſtance of the other ſide alike, you shall level your peece as before, right upon your white, then take a long ruler, which you shall lay upon the frizes, aſwell of the brich, as of the muzzle, and leaving it upon the mouth, you shal take your aime removing it at the brich ſo long, till you haue got in your ſight the place of the ſide shot which your bullet made, and without taking away your eye, or your hand from this ſight, removing the brich of your carriage, till the brich of your peece, comes to be right in the midſt under the ſaid ruler, which being done, take away the ruler, and take your aime level by the mettle of the peece, and you shall find your peece to be turned iuſt as much towards your left hand, as it shot before on your right hand. Moreouer, there are many occaſions, which may cauſe a bullet to ſtraggle either on the one ſide or on the other. The firſt is, when the boore is boored more on the one then vpon the other ſide, or by reaſon of the inequallity of the mettle, or that the mould is not right: this cannot be imputed a fault in the Canonier but in the Founder: neuertheleſſe, if he be ingenious, he may helpe this fault by his diſcretion trying his peece by his creuſet in, or ſcaling primer, and ſo help it as the fault may require.

A Peece alſo will carry ſidelings, if the tronions be not iuſt right the one ouer againſt the other. Alſo if the platforme be not layd even, but that the one part is higher then the other.

Item if a Canonier it taking of his aime ſtirs his eye from the iuſt middle of the frizes of the peece, and though he hath it, yet he may faile in not taking his aime iuſt in the middle of his mark.

Item if one wheele be higher then the other, the shot will fly alwaies toward the lower ſide.

Item if one of the wheeles should ſtay upon a naile, and the other not, as likewiſe when the one turns more eaſily then the other, and if one wheel should ſtand upon dirty ground and the other on hard, or when one of the Cubes or heads of the wheele is longer then he other.

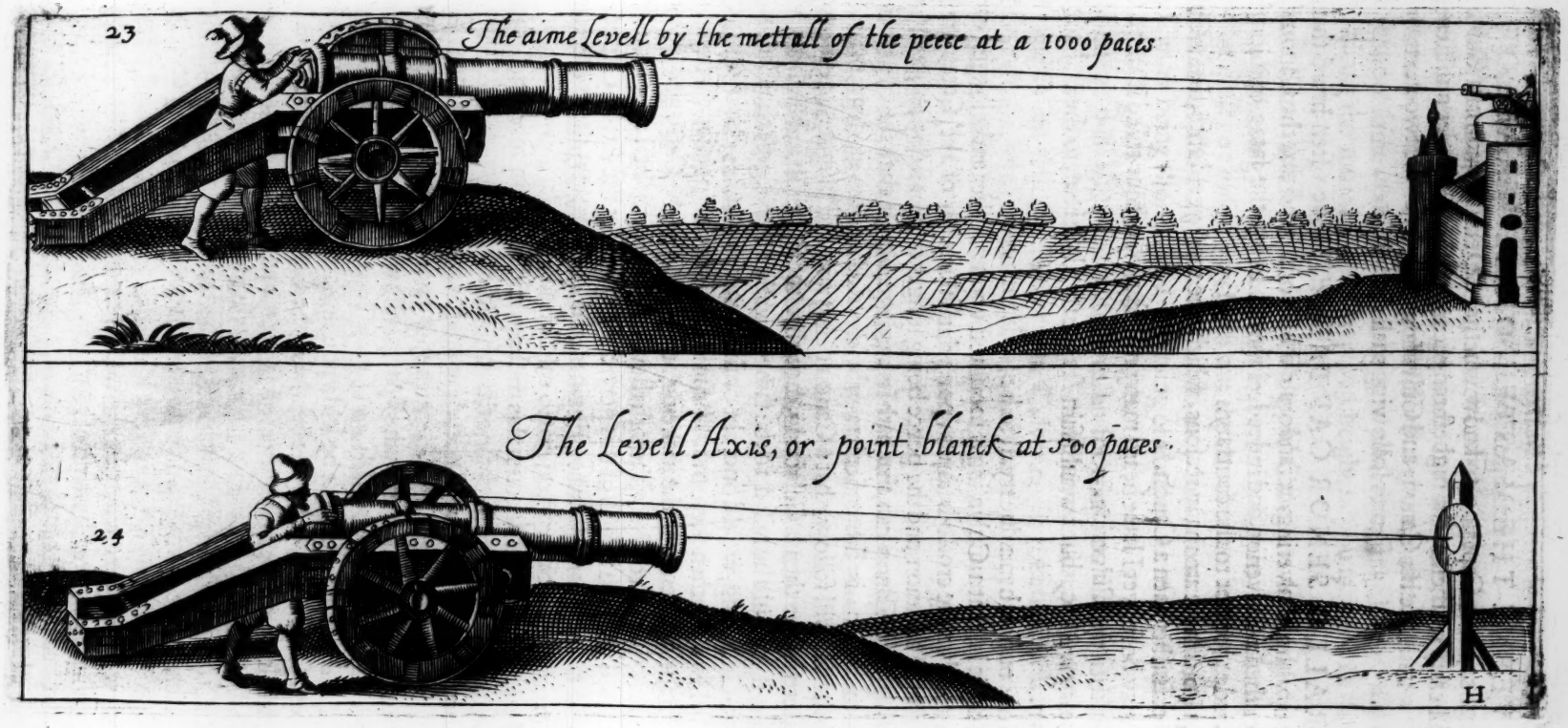
Item When the bullet is not driven home alike, or lies more upon the one ſide of the boore then upon the other: And Finally, the ſtraying of the bullet upon the one ſide may be cauſed by the vehemency of the wind, when it cannot be holpen.

Likewiſe a ſhort or an overſhot may be occaſioned either by the force or the weakeneſſe of the powder, or by reaſon of the unskilfullneſſe of the Gunner which knowes not to lay and levell his peece aright, neither knowes the true diſtance of the mark whereat he ſhootes.

All which I have marked at large, not as a matter to excuſe an unexpert Canonier but to give advice to the wiſe to have a vigilant eye upon all things, and to follow the rules above-ſaid, and ſo to prevent all inconveniences, for to faile the firſt time may paſſe, the ſecond may be pardoned, but the third time is too much, and cannot be excuſed, becauſe it is a certain ſigne of indiſcretion and want of iudgement; And indeed there is no fault which we have shown, but by diſcretion it may be remedied, whereof we have ſeen many examples at the famous ſiege of *Oſtend*, wherein a ſound iudgement was shown in this kind, whereof I will relate two examples.

A ſhip running into the haven to get into the Town, which brought the enemy ſome proviſion, a woman ſat at the helm to make us ashamed, order was given to a Canonier that he ſhould make a ſhot at this Steereſſe, who thinking it was too cruell a thing to ſhoot at ſo weak a ſexe, offered to take away the helme from between her hands, and to make the boat come floating towards us with the floud, if ſhe were not provided with an other, which he preſently put in practice, levelling his peece ſo right and diſcreetly, that indeed ſhooting of the helme it fell in the water, and the boat came floating towards our quarter, where it was pillaged and burnt in ſight of our enemies.

An other ſhip lying at anckor, ſtaying for a high water to come into the Towne, our men to ſinck it made many Canon ſhot at it in vaine, judging that the diſtance was too far to do it any harme, whereupon they were forbidden to ſhoot any more at it, and not to ſpend their powder to no purpoſe: But at laſt there came a Canonier who promiſed not onely to ſtrike the ſhip, but alſo to ſhoot the Cable in ſunder, ſo that by favour of the water the boat ſhould come floating to our mercy, and indeed, levelling and giving fire to his peece, he ſhot the Cable in peeces, and to the great admiration of all our Army, the boat came ſwimming to our quarter. Theſe examples I have related and will do others in the following Chapters, to ſhew the skill of a good Canonier that hath diſcretion and judgement in ſuch occurrences, and to give encouragement to all Canoniers and Gunners to do the like when occaſion ſhall ſerve.


23
The aime Levell by the mettall of the peece at a 1000 paces
The Levell Axis, or point blanck at 500 paces.
24
H

The first Dialogue.

BETWEENE THE MASTER, OR GENERALL OF THE Ordnance, and a Captaine, to know whether a Demy Canon or a Culvering will carry furtheſt at the higheſt range, and how a Canonier muſt levell, and raiſe his Canon, and Culvering to try it, as the two next figures following shall demonſtrate.

GENERALLO. SENOR CAPTAINE, I haue often heard that in trying of a Canon with a Culvering, at randome, it hath bin found that the Canon will carry its bullet further then a Culvering, and indeede I should be of the ſame opinion, if your diſcourſe perſwade mee not to the contrary.

Capt. My Lord there are many reaſons, which one muſt yeeld vnto, that a Culvering will carry its bullet further then a Canon.

Gen. It may be ſo, yet I haue heard many men ſay, who haue tryed it, that a Canon will carry further, then the Culvering.

Capt. It may well be, but I would fain ſee the tryall thereof, to the end it might be certainly known.

Gen. How ought then a due tryall to be made thereof.

Capt. Sure it is, that a Culvering is mounted vpon a higher and a longer carriage, then a Canon is, and that the croſſe-beames vpon which the brich of the Canon reſteth, being higher then that of a Canon, and the peece being longer cannot ſtoope ſo much as to elevate its mouth ſo high as a Canon can, that hath its carriage shorter, then the croſſebeames lower, for the shorter a peece is, the eaſier it may be elevated even to 45 degrees of the quadrant aboue ſaid, whence will follow, that a Canon being raiſed to a higher elevation, muſt needs carry its bullet further then a Culvering, not that the fault is in it, but that it wants its due elevation, for if it could be raiſed to the ſame elevation and degree the Canon is, then you should ſee the Culvering, would ouer shoot the Canon by far.

Generall. How ſo? then there muſt bee ſome fault in the Inginier, that made the mettall of it, or elſe in the Carpenter in the makeing or frameing of the Carriage.

Capt It may be in both of them, though they haue done their beſt endeavour, becauſe they haue not attained vnto the heigth of this perfection: for as in the Art of Gunnerie, ſo in the fabricking and framing of the other Engines and Inſtruments, there are many ſecrets in them, which a common capacity cannot ſo eaſely find out.

Gen. How shall we then diſcouer this miſtery, and to haue a ſure tryall therof, that the one peece may haue no more advantage then the other.

Capt. To haue a true tryall thereof, firſt the carriages of the one and of the other muſt be ſo rightly fitted, and locked with croſſe-beames low enough, to giue both the peece one and the ſame elevation, as you may ſee in the figures following.

Secondly. They muſt be planted upon two plaine and euen plate formes.

Thirdly, if the Culvering cannot be laid vpon the ſame height as the Canon is, then you muſt take away ſo much of the Croſſe beame of the Carriage, that the brich of it may ſinck, and the muzzle lie vpon the ſame elevation as the Canon doth.

Generall. What need is it then to take away ſo much of the Croſſe-beames, and ſo to weaken the Carriage, which may eaſelie bee remedyed by digging a hole in the ground, to make the brich of the carriage ſink into it, till the muzzle of the peece be raiſed high enough.

Capt. It may well be done, when there is no ſtrife nor diſpute about it, to which the contrary parties will never agree, becauſe of giuing an advantage.

Gen. What advantage can there be in this, to haue a peece to lye vpon a plat-forme, and to haue the brich of the carriage ſunke a little into the ground.

Capt. I am of that mind, that a peece, which hath the brich of the Carriage ſtept from recoyling,

trary part is will never agree, becauſe of giuing an advantage.

Gen. What advantage can there be in this, to haue a peece to ly vpon a plate-forme, and to haue the brich of the carriage ſunke a little into the ground.

Capt. I am of that mind, that a peece, which hath the brich of the Carriage ſtept from recoyling, will shoot its bullet with a greater force and violence, then that which lies freer upon an explanado, or a plat-form, And therefore to giue no advantage to a Culvering, it is better to shaue of ſome of the Croſſebeames, to cauſe it to ſinke lower, then to ly in ſuch a ditch by raiſeing the muzzell to the required height as you may ſee in the figures following.

Gen. I haue heard diverſe diſputes among good Canoniers touching this point, Who thought that a Culvering, could not carry ſo farre as a Canon, becauſe this peece being long, the bullet muſt go a longer way from out the chamber to the mouth, and that before the bullet comes out, the powder in that while may looſe ſome of the ſtrength thereof, whereas a Canon being shorter, and the flying of a bullet out of the Canon shorter, the powder will ſend it going with a greater ſtrength.

Capt. I belecue well that there is ſome reaſon for what you alledge for the length of a Culvering, and the shortneſſe of a Canon, when they are charged with that quantity of powder as their bullets require: but for your Culvering, in regard of the length of it, you giue it a greater charge, whereas for the charging of your Canon, you giue it in powder but halfe the weight of his bullet, and to an ordinary Culvering, you give it ⅔ in powder, or the weight of the bullet, but being a Culvering renforced, you may giue it as many pound of powder as the weight of your bullet.

Gen I will demaund of you Sir one queſtion more, and therewith conclude this diſcourſe, If you were to shoot at ships upon the Sea, what peeces would you chooſe to be beſt either your Canon or your whole Culvering?

Capt. Of this you may be aſſured from one that hath found it by experience, that there is no better peeces to do this then your Canon.

Gen. Giue me your reaſon?

Capt. Your Canon being shorter, may be laid lower, and better levelled, conſidering alſo that their bullets are weightier then the others, and fly more certain, becauſe neither the wind, nor the humidity of the water, can haue any ſuch great power to dead or hinder their flight.

Gen. How ſo? ſeeing your Culvering taketh a greater charge of powder, then your Canon, as you even now confeſſed is better, and will ding away the bullet with a more violent force.

Capt. My reaſon is that the wind and the moiſtneſſe of the water haue more power over a lighter, then of Canon bullet, which is heavier then a Culvering, now if you were to shoot at a ship of a like diſtance, you muſt raiſe your Culvering to your thinking two pikes length higher then the ship is, whereas your Canon will require but one pikes length of elevation aboue it. Therefore I haue made many a tryall of it at the ſiege of Oſtend, both of a Canon and of a Culvering.

Gen. Well Sir you haue ſatiſfied mee, and given mee good reaſons for what you ſay: but I pray you tell me whether a peece will carrie furtheſt, which is shot out of the Sea to the landward, or that which is shot from the shoare ſide, along the ſuperfices of the water

Capt. This were a hard queſtion to reſolue, if one had not made experience of it, Nevertheleſſe I will tell you what I haue ſeen, that wee shooting into the Sea from our batteries in Dunkirke at the Enemies shipping, which rid before the Town, we could ſcarce reach them, But I haue ſeen with admiration, that the Enemy shooting from their shipping to us ward, their bullets flew from that place, fiue hundred paces further, then ours did, where wee ſtood, yea ſome of them into the very Towne of Dunkirke.

Gen. Surely I was of a contrary opinion, thinking that a peece planted upon the firme

ground, the bullet would flie further, and with a more violent force, then that which is shot from a floating ship, becauſe the peece in recoyling shakes the ship, and by the shaking therof, the bullet may looſe ſome of its ſtrength, but theſe are ſecrets in nature, more admirable then apprehenſible.

Capt. True it is, that there are many hidden and ſecret miſteries in nature, but for this one may alledg ſome naturall cauſes: for a bullet shot from a ship to the land-ward, ſeeketh its naturall reſting place: but that which is shot from the land along the ſurface of the water, the bullet is forced to ſtriue againſt two elements, that is firſt againſt the aire, which retaineth it with all might, and ſecondly againſt the moiſtneſſe of the water, which alſo deads the bullet, cauſing it to ſtoope, for this hath bin found by experience to be true, that a bullet will shoot further into the Sea at a low water, then it will doe at a high Sea.

Gen. If a peece were ſo planted, that one could shoot both into the land, and alſo into the Sea, by turning the ſaid peece, the queſtion is, whether the bullet would flye furtheſt over the Land, or upon the Sea.

Capt. A Canon will carry its bullet a thouſand paces further over the Land, then it will do upon the ſuperficies of the water, and though we haue had no certain tryall of it: yet the ſiege of Oſtend hath taught us this experience, that we may be aſſured of it: For in the channell by Newport, when the battle in Flaunders was fought Anno. 1600. we shot at the Enemyes shipping and men of warre, to make them giue back, that our men might come up along the ſtrand with more ſafety, and leſſe danger to fight, we found that our bullets, which were shot at them from the land, could not reach them to doe them any harme, but the Enemies bullets, which were shot from their men of warre, shot amongſt us, and flew fiue or ſixe hundred paces over our heads.

Gen. That might well be, for perhaps the enemies peeces were either greater or longer then ours, or elſe that they had finer, and ſtronger powder then ours had.

Capt. The Calibres and boores of the one and of the other were alike, for their bullets fitted our peeces, but indeed in the goodneſſe of the powder there might be ſome difference, and for our parts to charge them well, we put a Ladle full of powder more then ordinary into ours, but this would not help. This queſtion I haue asked many times, both of Gunners, and Marriners, who haue given me alwaies this reaſon, that it was for ſome ſecret cauſe in nature, that a shot being made into the land, should fly further, then that which was made from the land into the water.

Gen. Though this troubled me a little yet I am glad to heare your reaſons, and the experience you have had. But I had almoſt forgotten to haue asked you one queſtion more, which now I call to mind how comes it to paſſe, that all the charge of the powder takes not fire, and is not conſumed in a Canon, aſwell as in a Culvering.

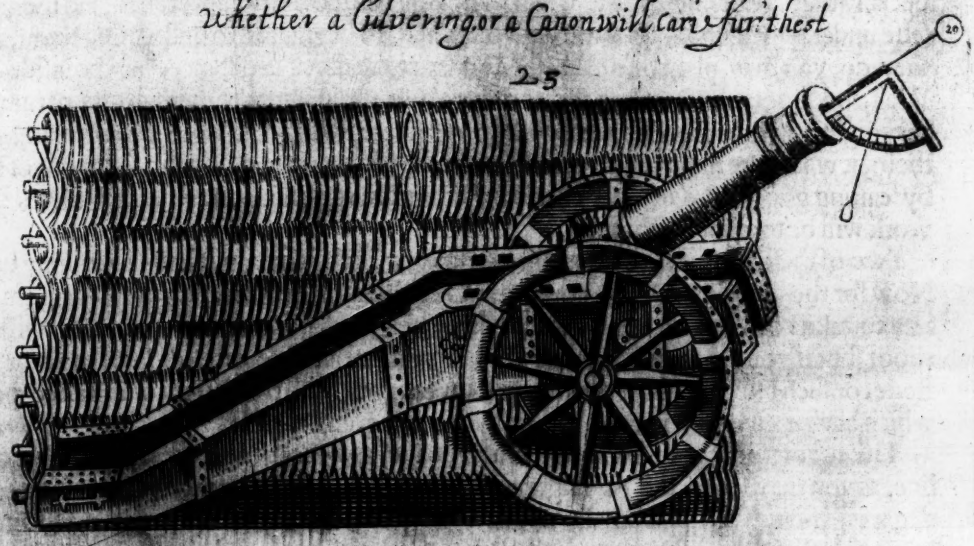
Capt. This is not any fault or advantage in the peeces, for one would thinke that a Canon being shorter, and of a Larger bore then a Culvering a ſmall part of the powder might bee expulſed or driuen out before it be all fired, and that a Culvering being longe and ſtraight, might keept in the powder till it takes all fire, but this is done at a venture, and yet notwithſtanding it happens oftner in a Canon, by reaſon of the biggneſſe of the boore, then in a Culvering, for after you haue giuen your peece its due charge of powder to ramme it vp ſome what cloſe into the chamber of your peece, you give it two or 3 shoues with the end of your Rammer, the powder being well corned; there lies ordinarily ſome looſe cornes and duſt by the way in the bottome of the mould, which the wispe or ſtopping hath not driven home, ſo that if a Canonier, doth not take very good heed, there will alwaies be ſome part of the powder shed in the peece, which will ly before the bullet, and when the reſt of powder takes fire thoſe looſe cornes flyes out, and cannot take fire, like as you ſee alſo that ſome shreds and peeces of the ſtopping after the shot is made, and ſmoaks without being conſumed by fire. So that your *La.* may be aſſured that any peece of ordnance be it either short or long, if the charge of the powder be well ſtopped and rammed home and ſome looſe

looſe cornes which will fly back gathered well up by the wiſp, there will not be ſo much as one Corn, but will all take fire. This is ſeen alſo in the tryall of Bombards and Morters, which though they be short, and large mouthed, fire and conſume, all their powder, without looſing ſo much as a graine.

Gen. Now I vnderſtand well, and confeſſe that hitherto I haue bin of the vulgar opinion attributing the cauſe to the shortneſſe of the peece and herewith we will conclude. Here follows the figure of a Canon and a Culvering elevated by levell vpon one and the ſame degree of the quadrant to try which will carry furtheſt at range.

Whether a Culvering or a Canon will carry furthest

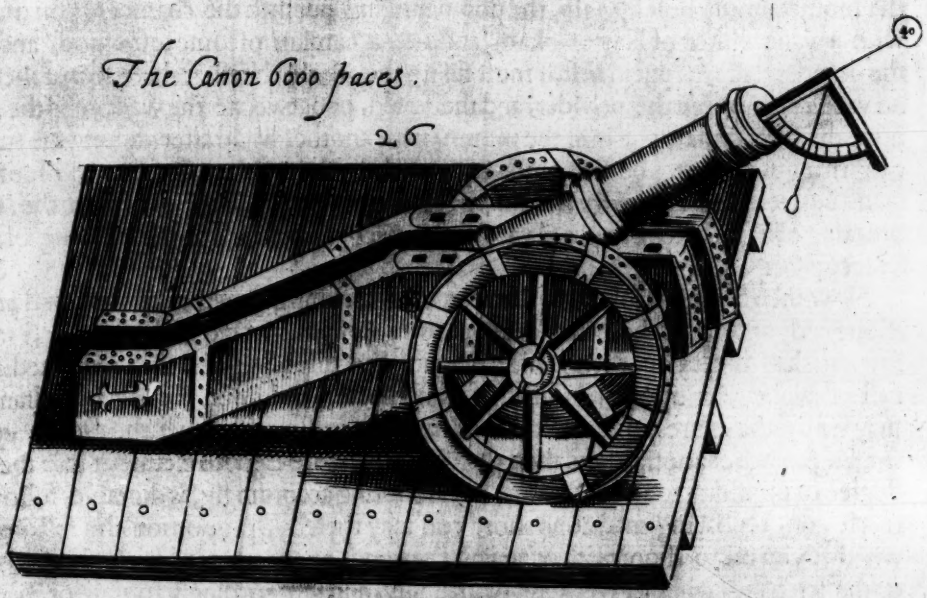
25



The Culvering will carry 7000 paces

The Canon 6000 paces.

26



CONTAYNING THE DEMONSTRATION OF Morters, and the vſe of them.

THE TENTH CHAPTER.

YOUR great and ſmall Morters, are not onely ſerviceable in a warre offenſiue, by ſhooting and caſting of great *Granadoes*, as of a 100, 150, 170 pound weight, and ſmaller of 40 and 50 pound, but alſo by caſting of Fire-balles, ſtones, old rubbidge, and peeces of yron into Cities, Townes, and Fortreſſes, and may be uſed alſo defenſiuely, to be ſhot from Townes, and Forts beſieged, into any Enemies workes, and approaches, eſpecially they are of ſingular uſe, when an Enemy hath covertly approached, and lodged himſelfe under ſome Bulwark, Tower, or Turret, and is a beginning to undermine them, which if they do, you may plant one of theſe Morters at a reaſonable diſtance, on the inſide of your Wall, and ſhooting your *Granado*, as it were bolt upright into the aire, by its naturall fall, it may light iuſt into the Enemies workes, and there with great violence, breaking among them, it will make them cry, flye, and forſake the place, you may alſo fire them out of a place, by caſting good ſtore of *hand-granadoes* down among them, and ſo annoy them, that the work will be too hot for them.

Two of theſe Morters are repreſented unto you, in the plate and figurs following number. Now for the ſhooting away of your great Granadoes or Firebals, you muſt ever remember, but to take $\frac{1}{5}$ or $\frac{1}{7}$ part of fine powder of the weight of your grandoe or thing which you ſhoot, but if you are to ſhoot away a bullet without any fire workes in it, or ſome maſſie ſtone, or ſuch like ſolid thing, then you muſt take but halfe the weight of it in fine powder, which having given fire to the Morter, will ſend it going merrily.

The uſe of them is not to ſhoot in a right line, as other ordance doe, but in an oblique line, as you may ſee by the two figures following, unleſſe your morter be mounted to 90 degrees, mounting them uſually aboue 45 degrees, namely to 60 70 80. and ſometimes more or leſſe, as the diſtance, and fall of your Granadoe or ſhot ſhall require.

Having before ſhown you the making and uſe of the *Quadrant*, it remaines now, that I come to the charging and uſe of a morter, now before you put in your powder, it muſt be well ſponged and cleared, whether you charge it with looſe powder, or Cartouch, turning the mouth almoſt bolt upright, the powder being put into the chamber, you muſt ſtop it with a wade, either of Hay or okam, and after a Tamkin of ſome ſoft wood, and this with the powder that was put in firſt, it muſt fill up the whole chamber thereof, that there may be no vacuity, between the powder, and the wadd, or betweene the wadd, and the ſhot, this done the ſhot ſhall be put in at the mouth, with another wadd after it, but you muſt haue a care that your Morter be not much mounted, leaſt your ſhot flies out too ſoon, and the wadd between the Tampkin, and the ſhot will not onely ſaue the ſhot from the Tampkins breaking of it, but alſo is to avoid vacuities, which may endanger the breaking of the peece by ſecond expanſions.

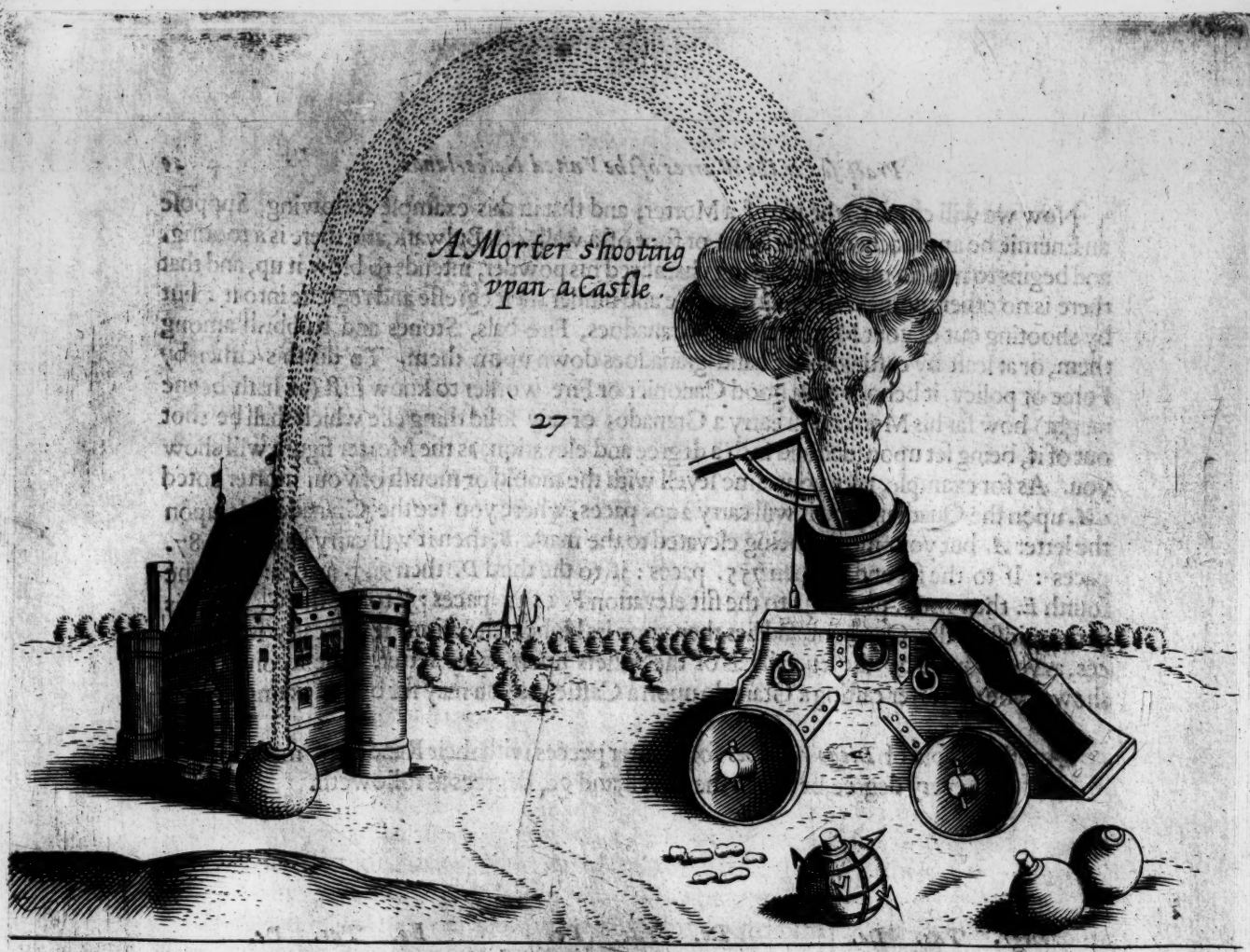
Now then having reſolved of the premiſſes, touching your peece, ſhot, and powder, as aboue ſaid, and upon the diſtance and monture of your mark, as the rules and tables following ſhall direct you, then for the bending and diſpoſing of it to the aſſigned mark, lay firſt a ſtraight ruler upon the mouth of your morter, and upon it place a quadrant (as you may ſee by the figures, or ſome other inſtrument croſſe-wiſe, to ſet the morter vpright for ſhuning of wide ſhooting, and then placeing them fore-right to elevate it into the reſolved degree of monture, to avoid ſhort or overſhooting accordingly, as the tables following will teach you, for having made one ſhot, you may thereby, proportion the reſt conſidering whether you are to ſhoot with or againſt the wind, or whether it blowes towards the right or the left hand, whether weakely, or ſtrongly, and ſo accordingly to giue or abate the advantage, or diſadvantage, which iudgment and diſcretion will induce you thereunto, and the helpe of the Rules following.

Now

Now we will come to the uſe of a Morter, and that in this example following. Suppoſe an Enemie be approached to the Baſis or foot of a wall, or a Bulwark, and there is a rooting, and begins to make a mine, and having chambred his powder, intends to blow it up, and that there is no other meanes left you to repulſe and hinder their egreſſe and regreſſe into it: but by shooting out of your Morters ſome Granadoes, Fire-bals, Stones and Rubbish among them, or at leaſt by caſting many hand-granadoes down upon them. To do this either by Force or policy, it behooveth a good Canonier or Fire-worker to know firſt (as hath beene taught) how far his Morter will carry a Granado, or any ſolid thing elſe which shall be shot out of it, being ſet upon ſuch and ſuch a degree and elevation, as the Morter figure will show you. As for example, take your aime levell with the mould or mouth of your morter noted *A.* upon the Quadrant, and it will carry 200. paces, where you ſee the Granado fals upon the letter *A.* but your morter being elevated to the mark *B.* then it will carry its bullet 487. paces: If to the ſecond *C.* then 755. paces: If to the third *D.* then 937. paces: If to the fourth *E.* then 1065. paces: If to the fift elevation *F.* 1132. paces: If to the ſixt *G.* which is in the midſt of the Quadrant, and lies then vpon its higheſt elevation, it will carry 1170. paces, as you may ſee by the ſeverall fals of the bullets upon every letter. The ſecond figure showes you a Morter caſting a Granado upon a Caſtle, as you may ſee by the example.

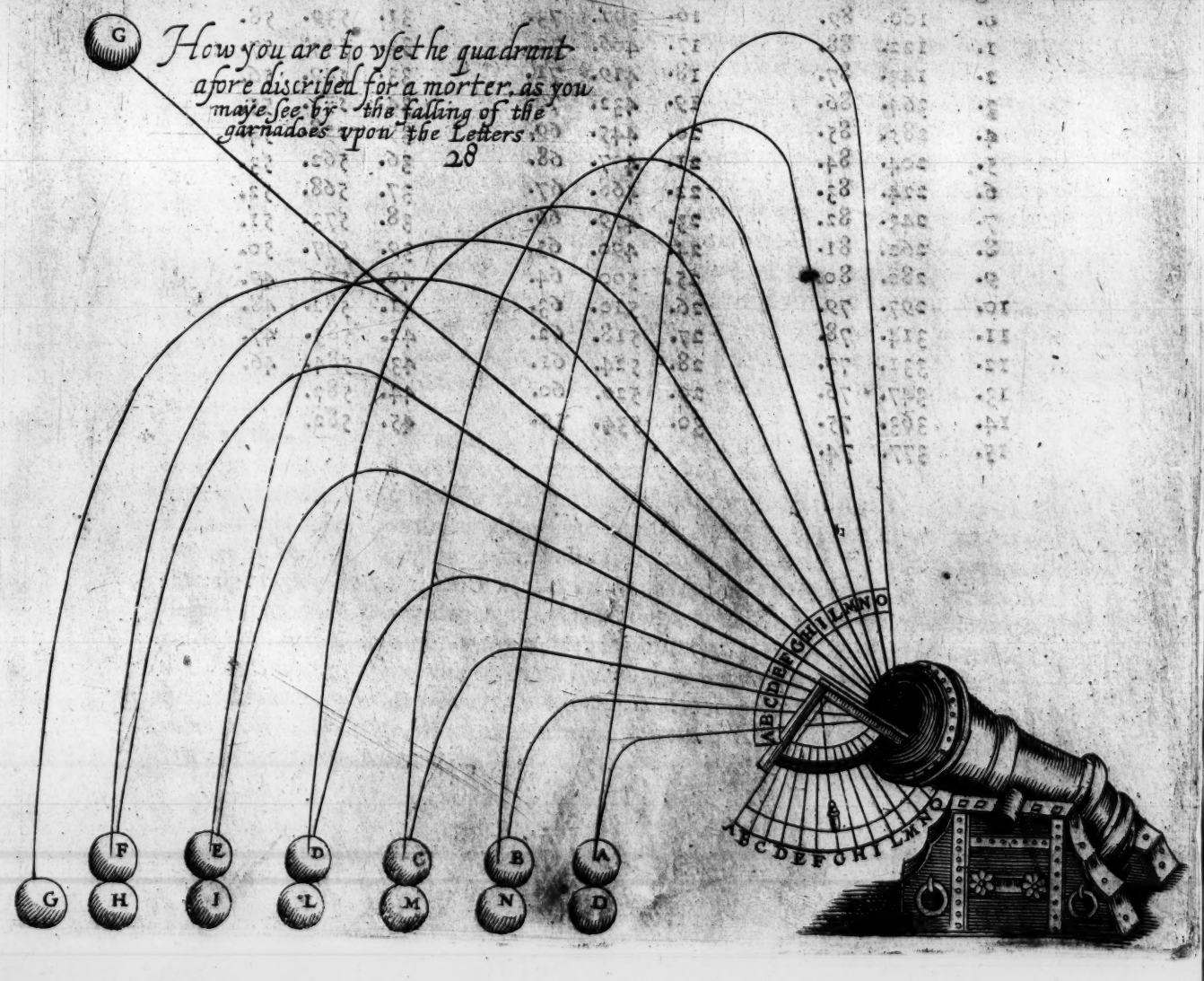
Another Table of *Diego Vffanoes* for Morter peeces with their Randoms, made for every degree, between the Levell, and 90. degrees as followeth.

Degr.	*Pac.*	*De.*	*De.*	*Pac.*	*De.*	*De.*	*Pac.*	*De.*
0.	100.	89.	16.	392.	73.	31.	539.	58.
1.	122.	88.	17.	406.	72.	32.	543.	57.
2.	143.	87.	18.	419.	71.	33.	549.	56.
3.	364.	86.	19.	432.	70.	34.	552.	55.
4.	285.	85.	20.	445.	69.	35.	558.	54.
5.	204.	84.	21.	457.	68.	36.	562.	53.
6.	224.	83.	22.	468.	67.	37.	568.	52.
7.	243.	82.	23.	479.	66.	38.	573.	51.
8.	262.	81.	24.	490.	65.	39.	577.	50.
9.	280.	80.	25.	500.	64.	40.	580.	49.
10.	297.	79.	26.	510.	63.	41.	582.	48.
11.	314.	78.	27.	518.	62.	42.	583.	47.
12.	331.	77.	28.	524.	61.	43.	584.	46.
13.	347.	76.	29.	526.	60.	44.	582.	
14.	363.	75.	30.	534.	59.	45.	582.	
15.	377.	74.						



A Morter shooting vpan a Castle.

27



How you are to vse the quadrant afore discribed for a morter, as you maye see by the falling of the garnadoes vpon the Letters.

28

TREATING OF COMPOSITIONS, MIXTURES AND Ingrediences for the making of your Concave, or hollow *GRANADOES*, both great and ſmall, to be shot or caſt out of a Morter, and alſo of your *HAND-GRANADOES*, to be caſt into a Trench, a Sapp, or the workes of an Enemy.

The Eleventh Chapter.

FIrſt, take three parts of Canon powder well pounded and ſifted, one third part of Greekish pitch, and halfe the weight thereof in brimſtone, mingle theſe two lightly together, and then add to them a half part of ordinary ſalt, and afterwards knead them well together with oyle of linſeed. This done, fill the pipe of a Cain with ſome of this paſte and commixture, for a tryall of it: if it carryes the flame cleare and faire, and blowes out of the pipe with an offenſiue force, without cleaving to the pipe into which it was put, then without all queſtion it is a ſigne and token of the goodneſſe and perfection thereof.

Now to charge a granado for your Morter or Bombard with this mixture and ingredience: firſt you muſt take a round ſtick to turn them about withall of the bignes that it may go iuſt into the touch-hole of your granado, which you are to charge by reaching down to the very bottome of it, and giue it a ſtamp or two with the ſaid ſtick, continuing ſo, filling and ſtamping it, untill you haue filled up the concaue of your granado up to the touch-hole of it within three or foure fingers breadth, then put into the pipe or hole of your granado an artificiall match, and fill it up round about the match with the aforeſaid Jngrediences even up to the very top of it, which you may do with your finger, without the help of the ſtick, becauſe the match will ſtand bolt upright in the hole, and in the very midſt of it. Laſtly take a peece of courſe linnen cloath and ſmeare it over with pitch and waxe well melted together, and lay it over the mouth of your touch-hole, in ſuch ſort, that the upper end of your match may peepe up a little throught a ſmall hole, made in your cloth, and then you muſt bind it hard about, by making your cloth faſt to the mouth of the Morter.

There are divers other receits, both for the making of your Compoſitions, for great and ſmall Granadoes, much differing one from the other, but of all others, this aboue is of excellent vſe, and therefore it is needleſſe for me to ſpend more time in the further ſearch and deſcription of them: onely remember this for a generall rule, that in all compoſitions, mixtures, and ingrediences, they muſt all be well dryed, pounced, and pulverized, but for your great morters, it will ſuffice if they be lightly broken. the fall, breaking, and operation of them, are able to teare, and breake downe houſes in peeces. The figures of the granadoes are marked A. B. C. vnder the Morter figure.

The ſame ingrediences will ſerue alſo for your hand granadoes if they be finely dryed, pounced and pulverized, as is aboue-ſaid, and thus much for your Bombards, Morters, and Granadoes both great and ſmall.

TREATING OF A PETTARD, WHICH IS A KIND OF A short peece of Ordnance, deuiſed of late yeares, for the blowing open of Gates, Ports and breaking down of draw-bridges, Their making, uſe, and manner of charging are here deſcribed.

see previous page of Index

The ~~eleventh~~ Chapter.

THE Modell or forme of a pettard, repreſented unto you in the next plate and figure, is not much unlike to a Grocers or an Apothecaries Spice-morter, and ſome are tapred much like a Coopers payle, little deeper then the Dyamiter of their mouthes, but being not aboue ⅓ in dyamitre at their bottome, or breech of their mouthes callibre, and in thickneſſe of mettell ⅓ of the Dyamitre at their breech, and leſſening by degrees in thickries towards their mouthes, Their magnitudes are ſome to hold but one pound of powder, or leſſe, and others to hold 50 pound or more, and they vſually allow foure pound of braſſe, or fiue pound of yron, to caſt a pettard for one pound of powder, and two hundred fifty pound of braſſe, or three hundred pound for a pettard that ſhall hold fifty pound of powder, uſing thoſe proportions diminished for leſſer, and augmented for greater, as Mr Carlyt in his practice of Artillery deſcribeth.

The demonſtration there of out iego Vffano.

Being maſſie and heavie (whereof the figure A. is the mouth, B. the breech neere the touch-hole) it muſt be carried upon a thick-board or planck, marked E.E. and then layd upon a Karr noted C. D. which ſerues not only for the uſe of it, but alſo to raiſe it, when you are to hang and faſten it upon a Port. This planchier in the midſt, hath a round hole in it marked H. Through which the noſe or mouth of your pettard is enchaſed. Aboue it there are two yron rings to hang it on to two Crochets marked G. ſcrewed faſt into the port marked A. with a match to giue fire unto it. A. A. are the Bungs, or tampkins wherewith the mouth of the Pettard is bunged or ſtopped.

The outſide on which the planchier is enchaſed being three inches thicke is even and plaine, armed with ſtrong plates of yron to defend it from ſplitting: it is alſo to be underpropped with the forked reſt, and ſtayed in the ground at the hinder end to keepe it from recoyling.

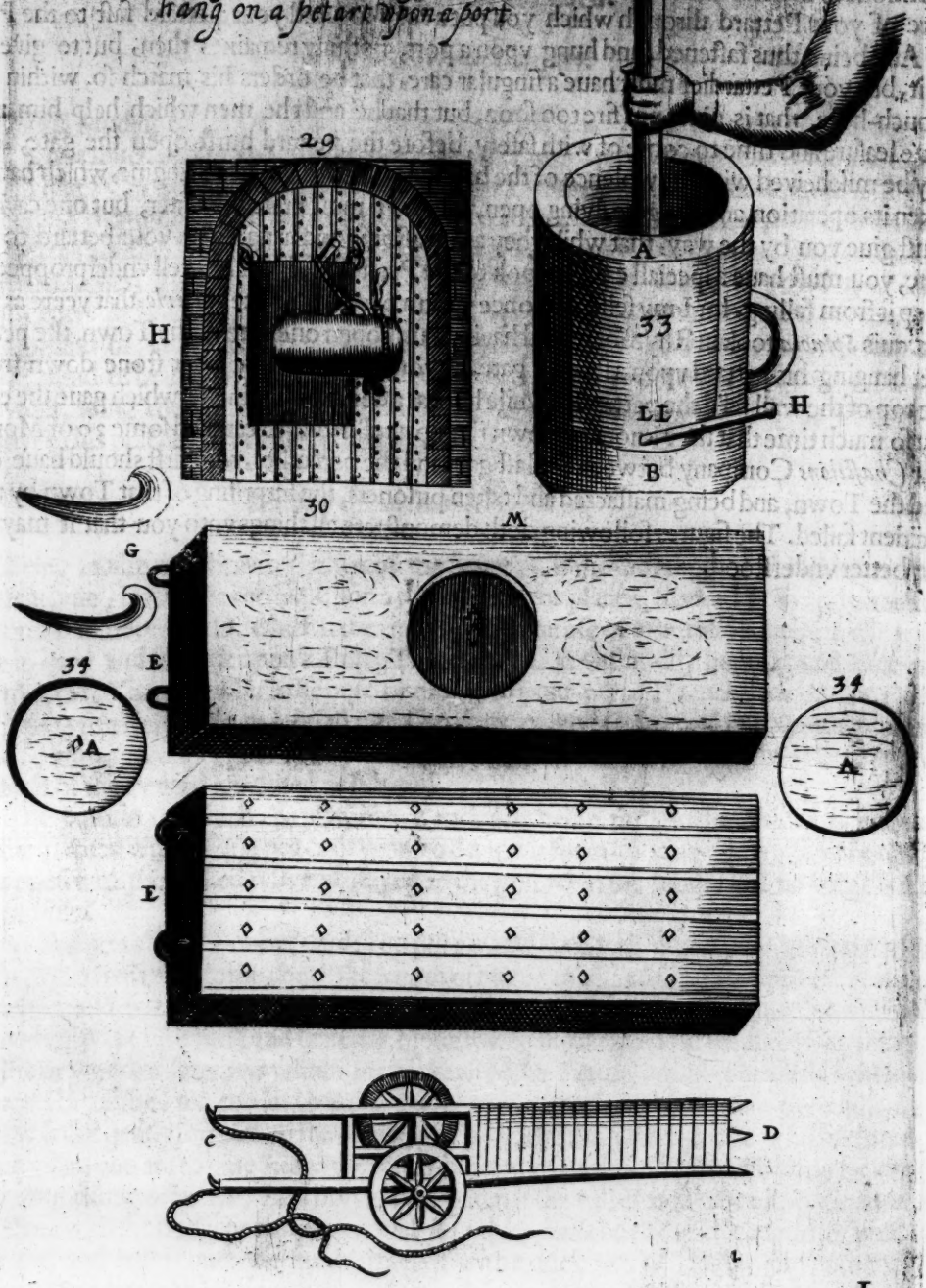
When you charge your pettard, you put a round ſtick into the very midſt of the mouth of it down to the bottome, about the length of halfe a cube, and ſome two fingers in circumference, and put no more into it at a time, then the better part of a pound of fine corne powder, and ſo fill it little and little, ſtamping it well in, round about the ſaid ſtick, with yron drifts or wodden ſtampers within the concaue of the Pettard, vntill it be filled within one fingers breadth of the top and haue its due charge, then turne your ſtick in the midſt about, draw it out gently, and fill up the hole out of which you draw the ſticke with fine powder, that when you are to giue fire at the touch-hole, the whole charge within may be fired in the twinckling of an eye, And having thus giuen it the full cgarge, then ſtop the mouth of it cloſe with the bung or tampkin noted A, which muſt be of the thickneſſe of your little finger, and laſtly couer the mouth thereof with a thick waxed cloath, and poure melted waxe vpon it ſome two fingers thick aboue the tampkin, and thus much for the charging of a pettard.

Now

Now we come to the faſtning and hanging it on a gate, to do this well, you muſt firſt ſcrue in faſt into the Gate the Crochets marked *G.* and make choice as neere as you can of the weakeſt place of the *Gate* or *Port*, where it may eaſilieſt be broken open, upon this hang your *Planchier* and put the mouth of your *Pettard* through the hole of the *Planchier* aboue mentioned, then faſten it firmly to the Port. There is alſo a third ring or a crochet, and the eare of your Pettard through which you put a roap to bind your pettard faſt to the Port.

And being thus faſtened, and hung vpon a port, nothing remaines then, but to give fire to it, but your Pettardier muſt haue a ſingular care, that he orders his match ſo, within the Touch-hole, that is giues not fire too ſoon, but that he and the men which help him may haue leaſure and time to come of with ſafety, before the pettard burſt open the gate, leaſt any be miſcheived with the violence of the breaking of this diabolicall Engine, which hauing taken its operation, and the gate flying open, your men muſt preſently enter, but one caviat I muſt giue you by the way, that while they are a faſtning and hanging on your pettard, to the gate, you muſt haue a ſpeciall care, to look to the Percullies, that it be well vnderpropped to keep it from falling, for I my ſelfe was once vpon a peece of ſervice at *Venlo*, that yeere as the Marquis *Spinola* took in Rhyn-berg, and having burſt open one gate of the Town, the petardier hanging his pettard vpon a ſecond gate, a woman throwing a great ſtone down from the top of the wall fel'd the pettardier while he was a doing his buſineſſe, which gaue the enemy ſo much time that they knocked down their percullis, and ſo catched ſome 30 of Mounſeur *Chaſtilons* Company between the laſt gate and the percullies, who firſt should haue entred the Town, and being maſſacred and taken pirſoners, the ſurpriſing of that Town by this accident failed. The figures following doth demonſtrate all things vnto you that it may be the better vnderſtood.

How you are to charge and hang on a petart upon a port

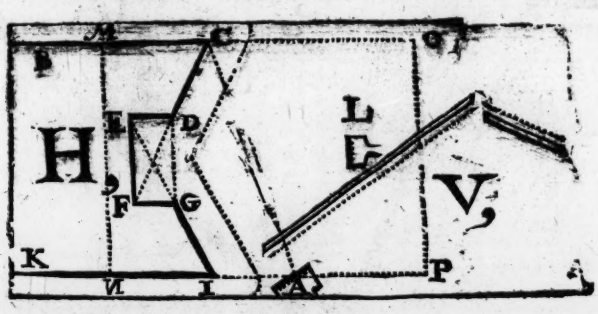


A QUESTION PROPOUNDED TO THE BATAVIAN INGINIERS, by Master *John Baptista* Mathematician of ANTWERP, for the Battering of a HORNE-WORKE.

ACCORDING TO THE PROVERB.

Let skill appeare by good demonstration.

And Dissolved and Resolved by that famous Mathematitian, Master JOHN STAMPION of the *HAGH* in HOLLAND.



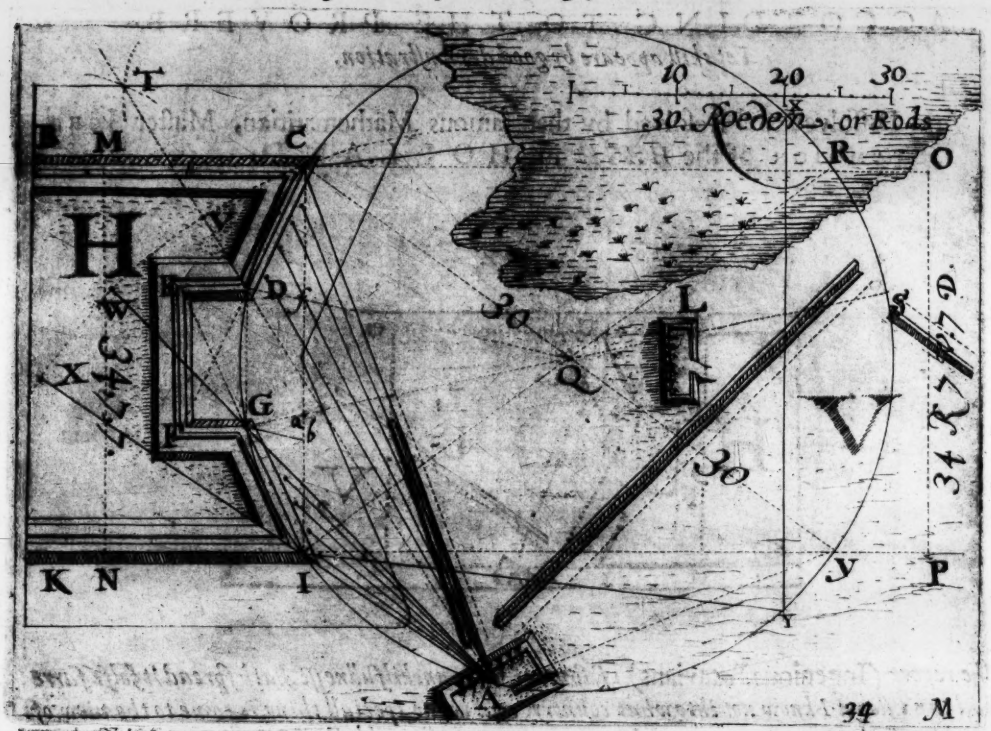
The report (Ingenious Batavians) *of some of your unskilfullnesse, hath spread it selfe farre abroad, and flown I know not into what country, and yet no speciall thing is come to the view of the world, whether out of your own selfe conceit, or from some blast of Superbitie: It is so that I my selfe have thought good to propose this question unto your ingenuity, as a Touchstone, that it may be dissolved, according to the true Touchstone of that noble Science of the Mathematicks by which it may be known.*

THE PROPOSITION IS THIS.

SUppose a Generall having approached to a certain Hornwork which is here decyfered by the Letter *H.* and hath come with his line or fapp near unto the moat of this Horne-work, and there desires to cast up a royall battery in the place noted A. for to flanck upon E. D. and D. C. in such sort, that the force of the Canon may beat aswell upon the Face as upon the Flanck, to wit, *Proportio Equalis*, by an equall proportion. Together that the two wings C. D. and G. I. and the distance G. D. which are all alike to each other, may be flancked with the lines and blowes, yet so, as the distance of the battery A. to the point C. be no more then sixty Rodd or six hundred foot, and the breadth of the Horn-work to be as M. N. or O. P. and being measured, is found to be 34. Rodd, 7. foot, and 4. Inches. The question is how this must be wrought.

Moreover of the same Horn-work the face is as much as the two greatest valuation of 1. *a.* there *a. 1. aaaa aaa.* 875. *aaaaa.* 3470. *aaaa.* 20640. *aa.* 104040. *a.* are alike to 5. *aa aaaaa.* 1147. *aaaaaa.* 28182. *aaa.* 118800. and the distance *A. C.* no further then 900. foot. *O. A.* and the rest of the conditions as aboveside. The question is to find out the breadth of the Horne-work, and also the other parts as is aboveside.

THE MATHEMATICALL DESSOLVTION VPON THIS Antwerpian Queſtion : Dedicated to all the Lovers of that noble Science, by Maſter *John Stampion de Jonge*, Mathematician.



Sirs. *The wing of fame hath of late fluttered out that now our ingenuity is brought to the tryall of the Touchſtone, by propoſing of a certain Queſtion under the name of Senior* John Baptiſta *of* Antwerp, *whoſe pate is ſwoln with ſelfe conceitednesſe and pride, which being not worth the anſwering, I will come to the ſolution of it, rather to give ſatisfaction to our* Batavians, *then to fulfill the deſire of the Propounder: And this may ſerve as an introduction unto it,* to the end, *that the honour which he doth aſſume unto himſelf, may not wholy be appropriated to him.*

THE DESSOLVTION.

LET this figure above of a Horn-work (as hee ſaith) be decyfered by H. whoſe breadth M. N. is known to be 34. Rodds, 7. foot, and 7. inches, and the required battered noted A. whoſe place is likewiſe found out by the known conditions. The firſt condition is, that the violence of the Canon planted upon the battery A. beates with as much force upon the flanck E. D. as it doth upon the Face C. D. whence it is manifeſt, that the Angle of the *eſpaule* or shoulder E D C. being devided into two equall parts with the right line T. V. D. A. that then this battery of neceſſity muſt come to be in the right line T. D. A. Secondly, that the face D. C. and I. G. and the diſtance D. G. may with the like Canon shot be flancked and beaten upon by the battery A. that is, when as the Angles I. A. G. G. A D. D. A. C. are alike one to the other, whence will follow, that through the five points, C. D. G. I and A. a circular circumference will paſſe. Now for that which concernes the third known part, namely, as that the batterie A. muſt be no further from C. then ſixty rodd, or ſix hundred foot, A. being the greateſt diſtance in the circumference as is in the third booke and fifteenth propoſition which is taken from of the middle-line of Euclids propoſitions, we have found out according

ding to this preparation, the middle line as *C. Y.* to be sixty rodds, the right line *C. I.* to be nine 34. rodds, 7. foot, and 7. inches, or 34. $\frac{17}{20}$ and the lines *I. G. G. D.* and *D. C.* to be answerable one to another. Let G. now be the Center, Then substract I. G. and Q. D. cutting through C.I. in A. and F. then will I. A. or I. C. be alike to one of the lines, I. G. &c. because now Q. I. stands alike to I. G. as I. G. is alike to G. A. and by the fourth proposition of the sixt book, as Q. A. is alike to A. F. so also Q. G. is to G. D. or as I. G. is to G. *A.* the cube upon I. G. with the corps which is made upon the quadrate I. Q. as superficies, and the depth I. C. are together alike to the corps upon the Quadrate I. Q. as superficies, and the depth to be three times the length of I. G. whence will follow, aswell by the corporall cutting of a dye, as we have shown in our New Algebra which shall shortly God willing come out in English, as by Sectione Com. by which I. G. is found to make 28. $\frac{1}{2}$ — *V* 263. $\frac{1}{4}$ so doth E. F. or D. C. likewise, and lastly the Angle E. D. C. being devided into two equall parts by the precedent T. D. then you have the cutting of A. in the circumference out of Q. where your battery is to be cast up.

Now whereas Mr Stampion hath not expressed the finding out of the face G. I. by reason of the little space contained therein, the more because he hath fully shown the Dissolution thereof in his new Algebra, we will here demonstrate the whole working thereof, how the face G. J. by his new Algebra annexed hereunto is to be found out.

The operation.

Setting down for G. I. x. so comes xxx + 31293 alike to 2700. x. or xxx—2700. x like to — 31293. which is an equality in the third case of the Algebra of Mr. *John Stampion*, which being changed by the second case comes to be xxx—2700. x. as 3129. is alike, out of this vacant number 31293. is extracted a Cubice-root, 2700. times, the side as Mr. *Stampion* teacheth in his new Algebra, pag. 112. and 113. comes the valuation of x 57. whereof the whole working shall here be set down as followeth.

The finding out of the first Letter.

5. 2700.
5. 5.
25. 13500.
5.
125.
13500.
—1000. The first substraction.

The finding out of the second letter.

	5	25	
	3	3	
	15	75	2193 (7
		2700	4800.
343	49	4800.	The devider.
		7. The second letter.	
	135.	33600.	
	60.	735.	
		41343	
	705.		
		41293 the last Substraction.	

This 57. is now the valuation of x as xxx 2700. x is like to 31293. for the same value the signe—set down commeth 57, for the least valuation of the equality then in xxx—2700 x is alike to 31293. Now to find out by this 57. the length of the face G. I. as followeth in the Rule fol. 138. of his new Algebra, that is, taking the half of 57. which is 28. $\frac{1}{2}$ and multiply the same quadrate, and the product will be 812 $\frac{1}{4}$. whose tripple is 2436 $\frac{3}{4}$. and being substracted out of 2700. the number x. remaines 263 $\frac{1}{4}$ whose square root is $\sqrt{}$. 263. and being deducted from the half of 57. as being 28 $\frac{1}{2}$ there remaines 28$\frac{1}{2}$. —$\sqrt{}$263, for the length of the face G. I. and E. F. and D. C. doth as much also.

Observe the manner of the Operation.

47.	2700.
$\frac{1}{2}$)28$\frac{1}{2}$.	2336.
28.	263.
224$\frac{1}{2}$.	
56.	
28.	
812$\frac{1}{4}$.	
3.	
2436$\frac{3}{4}$.	comes to be 28.—263. for G. I.

CHAPTER IX.

Generall. HAving brought your Approches neere unto a Towne or a Fortteſſe, whether would you chooſe a Bulwarke or a Curtaine to be battered with your Ordnance?

Captaine A Towne may be aſſaulted in divers places, ſometimes you aſſault one ſide, when as you make your Batterie on an other, Sometimes you chooſe a Bulwarke, otherwhiles a Curtaine to be battered, with this intention, to take in the Towne, aſſoone as poſſible may bee. As for mee, if I were to take in a great Towne which is populous, I had rather chooſe to batter a Curtaine, then a Bulwarke, which hath a high catt, or mount upon it: eſpecially, ſeeing that in great Townes the Bulwarkes lying one far from an other, they doe show the skirt of the Curtaine very open.

Gen. Why would you rather chooſe a Curtain then a Bulwark?

Capt. Becauſe your Bulwarks are alwaies ſtronger and better fortified then your Curtain, and being as it is the principall ſtrength of a place, and better furnished with platformes, flancks, &c. will require more time, labour, and charge to batter then your Curtaine.

Gen. But what Generall is ſo ill experienced, as to labour to batter a Curtaine, having two ſtrong Bulwarkes on both ſides of him, to flanker him when hee is to put over his Gallerie, and to giue an aſſault upon the Curtaine: peradventure for his labour and paines, hee may bee well beaten.

Capt. Soft (Good Sir,) Suppoſe that after a great deale of labour and paines you haue battered a Bulwarke, and falling up to the breach to aſſault it, you finde it cut off, and an Enemy lodged in it, muſt you not then beginne to ſap forward againe, to make a new batterie, whereas on a Curtaine there is not that meanes of cutting it off, as upon a large Bulwarke.

Gen. Haue you ever ſeene the experience of it?

Capt. Yes Sir, the Prince of Orange tooke in the Boſch by a Bulwark, and alſo Breda, but Maſtricht was taken in by making a breach, and ſpringing of a mine, upon the Curtain between Jonger Port and a bulwark, howſoever the Town of *Cortes* upon the frontiers of France, was firſt battered by the *Arch-duke of Auſtria* upon the point of a Bulwark, neer unto the very ioynt of the Curtain, where a high, and a ſtrong turret ſtood, which did annoy us much, ſo that we could not advance forward, but were conſtrayned to leaue off our approach on that ſide, and began to make a new Batterie for a breach in a Curtain on the Field-ſide, where there lay a ſtrong Bulwark to defend it, which did our men a great deal of harm, but wohſoever with great difficulty and much adoe, we took in the Town that way, by lodging our ſelues in the Curtain: Likewiſe the city of *Cambray* was battered, and taken in upon a Curtain, for all there were two ſtrong Bulwarks that flanked it, which if we had run our line upon a Bulwark, we ſhould not haue forced it ſo ſoon, yea ſuch an occaſion might preſent it ſelf, that a Generall may be forced to batter both the one and the other, or to find out ſome ſecret way by undermining a wall, and blowing it up with powder.

Gen. This is for your great Townes, but what ſay you to a Caſtle, a Cattadel, or ſome narrow Fortreſſe, how will you goe to worke to take in thoſe with the beſt advantage.

Capt. As for your Forts, and Caſtles, it is much better to batter them upon a mount or a Bulwark, then upon a Curtain: my reaſon is this, that in theſe your Bulwarks lying cloſe one by an other, will flank one an other with the greater force, and hide the Curtain much better to defend it, ſo that one cannot ſo eaſily force it, if the ſaid defences be not taken away.

Gen. Go to then; a Town then being to be battered, either upon a Curtain or a Bulwark how many peeces of Ordnance would you haue to do it, and how, and in what manner would you place, and plant your Ordnance upon your batteries to make a good breach?

Capt To effect this, I would haue 18. peeces of canon and halfe canon, *(for leſſer peeces for batterie are novv grovvne out of uſe)*.

Gen. Whether would you chooſe more whole canon or halfe canon?

Capt. To batter a place well either upon an ſtony or a earthy wall, you may aſſure your ſelf,

the more whole canon you haue, the greater and the more ſuffici ent your breach will be: for your great battering peeces doe ſpoile, and beate downe any thing, which doth meete with their great force and violence: *howſoever of late yeares experience hath taught at divers ſeiges that your halfe Canon vvhich are more portable, having good ſtore of them, vvill doe the buſineſſe aſvvell as your vvhole canon.*

Gen. But at what diſtance would you make your batteries, for theſe 18. peece of Canons and how neere unto the place, which you intend to batter.

Capt. I would counſell a Generall to approach as neere unto that place as poſſible may bee, and make his batteries ſome two or three hundred paces one from an other, and that if it were poſſible to advance covertly the Approch and ſap, even up to the Counter-ſcharfe, and very brinke of the moate, to prepare a way for his Gallerie: not onely to batter that place being at hand with the greater force, but alſo to keepe in, and hinder an Enemie from Sallying out upon the beſeigers, to diſcover and diſmount their Ordnance in *Caſemates*, or if they haue ſunke any in their walles or False-bray, and ſo to terrifie them, that they dare not ſtirre out.

Gen. I am alſo of your opinion, and hold it for good, yet I feare this will not be ſo ſoon done, and is ſooner ſpoken, then executed, and that before you can bring your approach and ſapp ſo far it will coſt you warme blood, and a great many mens liues, if you haue a ſtout Enemie within to deale withall, and one that is very Vigilant, and carefull to ſtand upon his Guard, and his defence.

Capt. T'is true, this cannot bee done without danger, and the loſſe of men, but hee that is fearefull muſt ſtay at home, and not come into the warres where there is neither place nor time, which doth free or exempt him from danger: yet the danger is not alwaies ſo great, eſpecially in ſuch places, where you haue Earth enough to worke with, to caſt up your ſapps, and to heighthen and deepen your Approaches, which will show you the more higher you finde the ground in Approching to the edge of the moate, the deeper trenches you may make and cover your ſelfe by caſting up of blinds continually, to keepe you from the ſight of the beſieged, and it is better when you haue brought your approach as it were under them, then if you were 200. or 300. paces diſtant from them.

Gene. I pray you Good Sir, how would you plant, and devide theſe 18. peeces of Canon?

Capt. I would make a great batterie with 8. of them to beate upon a right line, either upon a Curtaine or the point of a Bulwarke (which the Generall ſhall finde fitteſt) Two batteries with each 3. Canon to play ſlope-wiſe from the great batterie as the ninth plate and 28. and 29. figures showes, and two batteries, with two halfe Canon a peece to play as it were croſſ-wiſe upon the breach, and thus you ſee your 18. peeces planted upon 5. bateries, as you may obſerue in the ninth plate and the two figures of a Curtaine and of a Bulwarke following.

Gen. Good Sir tell mee I pray you how many ſhot will theſe 18. peeces of Canon make in 10. howers, and how much powder will they require.

Capt. In 10. howres they may make ſome 1500. ſhott, and will require a matter of 25000. pound weight of powder, that is 150. barrels full, each barrell contayning 160. pound weight in it.

Gen. You make your account then that every peece in the ſpace of 10. howrs is to ſhoot 80. ſhot, that is 8. ſhot an hower for every peece.

Capt. You may make 10 ſhot in an howre if you pleaſe, if your peeces be renforced, but as for your ordinary peeces, they haue not mettailline ſubſtance enough to beare it: conſidering alſo that after you haue made 40. ſhot out of a peece, it will be ſo heated, that it muſt haue a cooling time, which muſt bee at leaſt an hower, for otherwiſe your peece being growne over hot, it may cauſe danger.

Gen. Me thinkes that 80. ſhot for a peece in ſo long a time were too little, having often heard, that in that while, a peece may well be ſhot of 130. times, can you giue me your reſolution upon this?

Capt. I will tell you Sir what hapned once in the Iland of *Bomble* Anno 1599. we planted a peece by a mill, by which we did annoy the Enemy very much, ſo that they were forced to

make

make a battery, and planted a whole Canon and a demy-canon upon it, ſeeking to diſmount ours. Now shooting with this peece from foure of the clock in the morning, till eleven toward noone, this peece had a cooling time the ſpace of two howers, and about one of the clock, wee began to play with it againe, and continued shooting with it till 4. a clock in the afternoon: but this peece being not able to endure the force and heating of ſo many shot, we were conſtrain'd to leaue off with it and yet ceaſed not shooting with our other peeces from an other batterie by command from *Don Lewes de Valaſco* Generall of our Ordnance, and shooting croſwiſe with ſome other of our peeces, wee put the Enemies two peeces to ſilence in the ſpace of an hower, a Souldier of ours ſtanding by, was curious to keepe a taily of the number of all the shot we made from the morning till foure a clock in the afternoone, and showed mee 80. notches, which deducting the two howers cooling, our peece planted at the mill made 8 shot in an hower, which was as much as could be required of it.

Senior Diego Vffano *giue your Tranſlatour leaue to interrupt you a little, and ſo to conclude this diſcourſe. Iffyou remember at the ſeige of Oſtend which you mention often in your Chapters and dialogues you were without, and I was within the Towne, that on the ſeventh of January Anno* 1602. *Stilo Novo, After Sir* Francis Vere *offamous memory (who defended and kept the Towne againſt you) had deluded you with a* Parley, *onely to gaine time, and to make up our Canon and Sea-beaten workes, along the skirt of the old Towne, his highneſſe the Archduke reſolved to aſſault us, and that morning began to batter* Sand-hill *and* Schotenburgh *to make a breach for you againſt that night, with intent to Aſſault us (as you did) and to haue entred the Towne, and haue put us all to the ſword, the Relation whereof you ſhall heare in the end of this booke. Now you had placed and planted your* 20. *peeces of Canon to batter them in this manner,* 8. *from your batterie at the foote of the* downes, 8. *from a batterie on the right hand of the downes,* 6. *more which you had made upon the ſand, and as it were raiſed out of the ſea: the firſt shot upon the breach in a right line, and the other* 2. *ſlopewiſe, as your two figures following doe demonſtrate. Theſe* 20. *peeces of Canon towards noone had a cooling time, for a matter of ſome* 2. *howers, juſt as you haue ſaid, and afterward you began to batter the breach and old Towne againe, till it was almoſt twilight, and then they cooled againe, till you were readie to giue us an aſſault, and before you fell on as I doe well remember, you shot of one of your Canons with a hollow bullet which flew over the Towne and made a great humming noiſe as a warning peece to the* Count of Bucquoy, *who lay on the Eaſt ſide, that you were then ready to fall on, and that he ſhould doe the like, this was your Signall: Now* Generall Vere *knowing well your intent, gaue order to the Gentleman of our Ordnance who had the guard upon* Sandhill, *that hee ſhould keepe a true* taily, *and an account of all the shot you made that day with your* 20. *peeces of Canon upon the breach and the old Towne which being caſt up, there were found to be made that day from morning till night* 2200. *shot, which was found to be an* 110. *shot for every peece, and* 11 *shot an houre for every peece, which is more then* 8. *but I verely beleeue your peeces were renforced.* This by the way, and ſo I returne againe to your owne dialogue.

Gen. (Good Sir) I pray you show mee how you would batter the point of a Bulwarke (as the figure 28. following demonſtrates,) and giue mee ſome reaſons aſwell defenſiue as offenſiue.

Capt. I am willing to giue your Lordship content, and ſay, If I were to batter the point of a *Bulwarke* or a *Baſtion*, I would haue the ſame number of battering Canon, and planted in the ſame forme and manner as they were for the Curtaine and to shoot sloope and croſſwiſe alſo, and if your approaches were advanced ſo farre they should be planted upon the very brinke of the moate and upon the *Counterſcharfe*, I would plant 4. of them ſo, that they should diſmount the Enemies Canon in their *Caſemates*, or any if they had ſunk them in their *Falſebray* which should waite vpon that occaſion.

Gen. I am of your mind and preferre ſuch a battery before all others who are of the opinion that they had rather chooſe a Curtaine then a Bulwarke to be battered.

Capt. You haue heard my reaſons for that, and ſee the figures following traced out to you. But as for your *Bulwark* the *beſieged* may cut it off (as you may mark in the figurs of *retrenchments* and *Cuttings off* in the ſecond part of this booke) for indeed it will be a hard matter to force an Enemy out of a Bulwark, who is reſolved to looſe it by peecemeale and

degrees and there is not ſo much danger in aſſaulting of a Curtaine, which being once well battered and beaten down with your Ordnance, you have an eaſier way and entrance to fall on with your troupes of men, to enter the Towne or Fortreſſe, but for the defence which is made from your flanking Bulwarks, or your Caſemates, you muſt make batteries upon the brinke of the moate againſt them, (as is ſaid) to diſmount the Enemies peeces, and to flanker with your Ordnance the parapets of the Bulwarkes to beate them about their eares, that the bulwarks may lie the more open to you, and I think this way is the leaſt danger.

Gen. But the beſieged their cuttings off, may they not be made aſwell upon a Curtaine as upon a Bulwark?

Cap. No, for the Rampier being thinner, you have neither ſo much ground, nor the like accommodation in a Curtain as in a Bulwark, and indeed, a Governour of a town or of a fortreſſe if he were put to his choiſe, had rather to be aſſaulted on a Bulwark (then on a Curtain) by cutting it off into the form of a halfe moone, that he might make a new reſiſtance, and defend it with a leſſe number of men: Beſides, in a Bulwark the beſieged have this advantage over the Aſſailants, which is very dangerous for them, that they may make a mine within the bowels of their Bulwark, when an enemy shall attempt to aſſault it, and thinking to enter the breach, and take the town, they may be blown up into the aire by a countermine, the like alſo may happen to the beſieged, the Aſſaillants ſpringing their mine alſo in a Bulwark, when they think they ſtand upon their beſt defence.

Gen. May not the like be done alſo in a Curtain?

Cap. No, It will not take the like effect as in a Bulwark, for a breach being once made in a Curtaine, for as an enemy may aſſault it at large, ſo they may bring a greater number of men to fight to help to defend it, whereas in a bulwark they are pend up and ſtraighted in a narrow place, which may be cut off, and will require a fewer number of men to defend it, whereas thoſe which are to force it, muſt be conſtrayned to bring up a great many men to aſſault, who in an inſtant may be in danger of blowing up.

Gen. Your reaſons (good Captain) are not to be ſlighted, but as for me, I hold it ſafer to batter and aſſault the breach of a bulwark then of a curtaine. For though the beſieged may cut it off, and defend it with a fewer number of men, yet the Aſſaulters have this advantage over the beſieged defendants, that they have more place and elbow room, and may find a leſſe reſiſtance then in a Curtain, ſeeing that one may make as great a breach in a Bulwarke, as in a Curtain, becauſe your Ordnance may beat it flat and levell with the ground, and chooſing rather a Bulwark: I will herewith conclude this diſcourſe, and now ſhew you the figures both of the one and of the other in this plate following.

HOW AND IN WHAT MANNER A GENERALL OF THE Ordnance ought to plant his Canon in a day of Battell, whereby hee may most annoy an Enemy.

Extracted out of the second Treatise of Don Diego Vffano *his fift Dialogue between the Generall of the Ordnance, and a Captain, as followeth.*

Generall. SIR, I would fain know of you, how Ordnance ought to be placed in a Day of Battell, for to gaule the Enemie most?

Captain. I make no question but your Lordship having had experience in the Wars of *Savoy* and *Hungarie*, can tell better then I am able to speak, and if I should use a tedious discourse, it might then seem that the Scholler might presume to teach his Master.

Gen. Howsoever, in such a case I would willingly take the advice of an old experienced Souldier, and especially of such a one, who hath served in these parts. As for me, I dare not boast of any great experience, having had enough to do to look unto my owne affaires, neither have I had much leasure to inform my self well about Artillerie. But now seeing I am to receive that charge upon me, I pray you tell me, as a man who hath been beaten thereunto, and hath had long experience in the Warres, how they do use to plant Ordnance in these quarters.

Capt. Sir, There hath been but a few battels fought in these parts, and to speak truly I am not able to satisfie you touching this point. Nevertheless, I will tell you what I have seen in two, wherein I was present. In the one the Ordnance was planted in the head of the Battalions, and in the other between them, two by two, and three by three, upon the flanks and wings of the Muskettiers, and blinded with the wings of the Cavallerie. But as for me, I am of the opinion that it is best to plant some peeces in the front of the Armie, which may play upon the Enemies troopes on all sides: seeking out alwaies for this effect, some places of advantage to place them in, that you may not be in danger of loosing your peeces. And though you cannot get such an advantage, yet your peeces being in the head of your Battell, will be of lesse service, because when you are to come to the Chock and joyning of Battels, they may in some wise annoy your own men, which I saw in one of these Battels aboveSaid.

Gen. Therefore I think it were fitter they should be placed upon both the flanks, and in the Reere of the Battaillions, by leaving a free place of Armes, which may give no offence to our own men.

Capt. I can hardly beleeve (*Illustrious Sir*) that that would be so expedient, for an Enemie perceiving that the Front is left bare without Ordnance, he will take the more courage to fall on, and come up to the charge: Therefore, I hold it more fitting, that the Artillerie may be devided some here some there, both before the Front, and upon the Flanks, placed some fifty or an hundred paces one from anothet, and then there will be no danger when the Enemie shall come up to Chock, to encounter you, or offend our own men, especially when they are fastened to them by drawing-Ropes and yron Rings, that upon an instant they may be remooved and turned for the advantage of our own Troops, and give fire as fast as they can charge and discharge among the Enemies Troops, which is a matter of great moment for the obtaining of a Victorie.

But it happens very seldome that such convenient places can be found for the planting of Ordnance in a Battell, as were to be wished, for oftentimes one shall be driven of necessity to make choice of such places as the ground will afford, by reason of woods, hills, marish grounds, and such like disadvantagious places as you may meet withall, and for which one can give no certain rule, but that the Generall by his wisedome and discretion may make choice of the best advantages, which may annoy the Enemy most, and give the least offence to his owne men, either by dazling them by the sun, the raising of Dust, and

which way the wind drives the ſmoak, both of Ordnance and ſmall ſhot, which though little in themſelves, yet may prove to his men great impediments and diſadvantagious. But leaving theſe things, we will now return again to our former diſcourſe, becauſe your Lordſhip is of the opinion that the Ordnance ought rather to be planted upon the wings and flanks of the Battailions then otherwiſe, which I dare not approve of, in regard that when the Troops are to encounter with the Enemy, and come up to the charge, our own men may be more annoyed by our own Ordnance (which may breed a confuſion) then the Enemies; when as the wings of our horſe which are upon the flanks ſhall come up to charge the enemie, ſo that our own peeces might puzzle them greatly, when as they are to play from the flanks, beſides the miſchief which might happen among our own men. Therefore one ought to be very carefull and circumſpect in planting them, and this is that which out of my own experience I am able to ſay upon this queſtion. Wherefore I do adviſe every Captain of the Ordnance, and Maſter-Gunners, to uſe ſome light field peeces, and ſmall Drakes, which upon every occaſion may be remooved from one place to another, and couragiouſly advanced to the places of moſt advantage, which might offend the Enemie.

Gen. *Sir*, The reaſons you uſe have given me good ſatisfaction, but I pray you reſolve me of one thing more, that is, how a Generall of the Ordnance ought to carrie himſelf in the day of Battell.

Capt. In ſuch a time the Generall is to show moſt his wiſedom, diſcretion and experience, which chiefly conſiſts herein, that he and his Lieutenant keep their train together in good order, to have a vigilant eye upon all accidents that may fall out, and to make choice of ſuch ground for the planting of his Ordnance as the Generall of the Army and he ſhall think beſt, to ſee that all things be in a readineſſe, the Ordnance well placed, and that the maſter-Gunners, Gentlemen of the Ordnance, and Canoniers do their beſt endevour, and acquit themſelves like men. It is partly alſo his charge to ſee that the whole Army be well provided with Munition, as powder, bullets, and match, becauſe the Ammunition marches under his Train, He is to be near the Generall of the Armie upon all occaſions, to receive his directions and commands, and to ſee them executed ſpeedily, and to know of him after what form he will make his Battell, that he may plant his Ordnance accordingly, and ſo to find out hils and heights, to play over his own men, and offend the Enemie moſt. And when an Enemy ſhall preſent himſelf, and come up to the charge, to draw and plant his Ordnance as neer their horſe as poſſible may be, to hinder them from breaking in upon the diviſions of foot, taking along with him Saylors and Pioniers to help to draw up the Ordnance, and ſufficient guards to defend them, and this is that which in ſo great a buſineſſe is the charge and duty of the Generall of the Ordnance, and which may be required of him.

Gen. *Captain*, This diſcourſe hath pleaſed me well, and given me good contentment, and I am glad that I met with you upon this occaſion. *Adieu.*

THE TENTH CHAPTER.

TREATING OF THE DIVERS SORTS OF BRIDGES VSED IN the ſervice of the Lords the States of the Vnited Provinces.

MAny a brave occaſion in the warres hath bin loſt for want of Bridges to paſſe over a River a Brook, or a Moate, therefore the States for any peece of ſervice, have alwaies diverſe bridges in a readineſſe, both ſmall and great. The ſmaller ſort for any ſuddain enterpriſe, or for putting over the moat of a Town, a Horn-work, or a Half moon are 3. as firſt a Corke bridge now not in uſe, ſecondly a Bulrush bridge, the pecces whereof are ten foot long, and ſix or ſeven foot broad, that foure men may go over them in Front, deſcribed unto you in my ſecond part in the Chapter of Approches, figure 159. whereof many peeces being joyned faſt together with ropes and Ankors, will lay a bridge over a moate, a brook, or a ditch for men to paſſe over, the third ſort is a wicket, or a basket bridge, as ſhall be hereafter deſcribed.

Moreover they have three ſorts of other Bridges, namely, a ſmall boat bridge, with beames, plancks, roaps, and ankors, which are carried upon long waggons in the Army, whereof you may ſee one of them in this treatiſe, chapter the third, figure ten, of theſe we have commonly twelve, that goes along with our Army upon a long waggon, drawne with 15. couple of horſes, and a Thillet horſe.

Beſides thoſe above mentioned, there are two great bridges, the one called a punt bridge which is laid long waies, end to end over the Rhine, or any other great River, and the other a Maze ſchip bridge, as you ſhall ſee in the figure following.

Command then being given to the Captain of the Bridges and his men, for the firſt they lade Ordnance, and all manner of equipage in thoſe great Punts, as beames, plancks, cordage, cables, ankors, windlaſſes, winches, and all other neceſſaries, to bring them up to the Rendevous.

Now when the Captain of the Bridge is to lay a great Punt bridge over the *Rhyne*, or the *VVhale*, as at *Nemegen*, *Schenckſconce*, *VVeſell*, or at *Rhynebergh*, taking firſt the breadth, and diſtance of the River from the one ſide to the other, they can eaſily give a geſſe, how many of theſe punts being 50. foot long, and 10. foot broad, will ſerve to reach over the River. The firſt punt then being laid longwiſe from the edge of the one ſide of the River being faſtened to two great Stakes (and Ankors) driven into the ground, they then lay at the futheſt end of the firſt punt, and other punt laying Brush at both ends of the punts, which riſes and falls, that horſe and waggons may paſſe over them, and alwaies faſten and bind them together with ropes and cables which ſtayes the punts, by caſting out ankors and cables into the ſtreame, to hold them faſt together, and thus they do till they have laid over 15. or 16. of theſe long punts which will reach over from the one to the other ſide of the river, at the end whereof there are caſt up two halfe moones, (if it be not neare a Town, and a Steckado or two Gats made, that none may paſſe over it without leave, having alwaies a guard to defend it and keep it from burning.

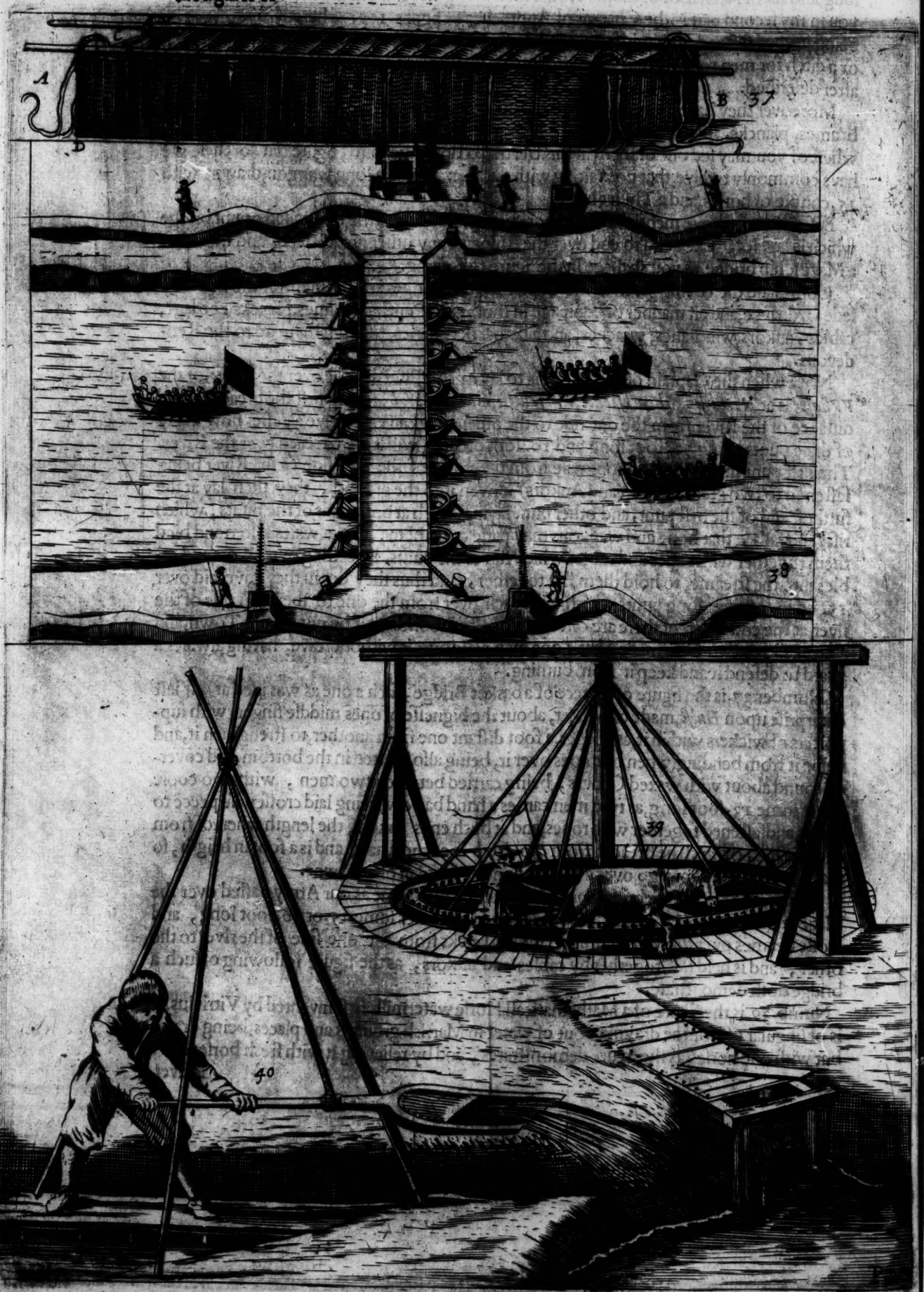
Number 37. is the figure of a peece of a basket Bridge, ſuch a one as was uſed at our laſt enterpriſe upon *Hulſt*, made of wicket, about the bigneſſe of ones middle finger, with ſupporters of wickers within it, as hedges, a foot diſtant one from another, to ſtrengthen it, and helpe it from bending, when one goes over it, being alſo matted in the bottom, and covered round about with waxed Canvas, being carried between two men, with two coole ſtaves ſome 13. foot long, as two men carries a hand barrow, being laid croſſewiſe peece to peece, and faſtened together with ropes, and at both ends ankors, the length whereof from *a* to *b* is 6. foot, and the breadth from *c* to *d* two foot and a half, and is a foot in heigth, ſo that 2 men in front may go over a moat upon any ſupriſall of a Towne.

Number 38. is a Maze bridge laid croſſewaies, ſuch a one as our Army paſſed over the Maze at the *Grave*, *Venlo*, and *Maſtricht*, having beames ſome 15. or 16. foot long, and croſſe beames over the Maze ſchips, with plancks from the one ſide of the river to the other, and is held faſt together by cables and ankors, as the figure following of ſuch a bridge doth demonſtrate.

Numb. 39. is the figure of a Mathematicall Horſe watermill, firſt invented by Vitrivius, & is of ſingular uſe for the drayning out of water in Marriſh grounds and places, being drawn but with one horſe, as the figure demonſtrates, and by relieving it with fresh horſes and a

driver may go night and day, the experience whereof we ſaw at the ſiege of the Boſch, what abundance of water twenty of them drayned out of the overflown Meddows and the River of the Dummell, which did help and further our Approaches greatly.

Number 40. is the figure of a *Water Scoop*, made after this manner following, firſt you take three long poles or ſpars, and at the top bind them together with a match or a cord, from the top whereof diſcends an other cord, which is bound faſt to the haft of the Scoop, as you may ſee, and the feet of the ſpars put into the ground triangular wiſe, with which you ſee the figure of a man caſting water out of a moat or a ditch. This plate following will ſhew you the figures of all that is ſaid above.



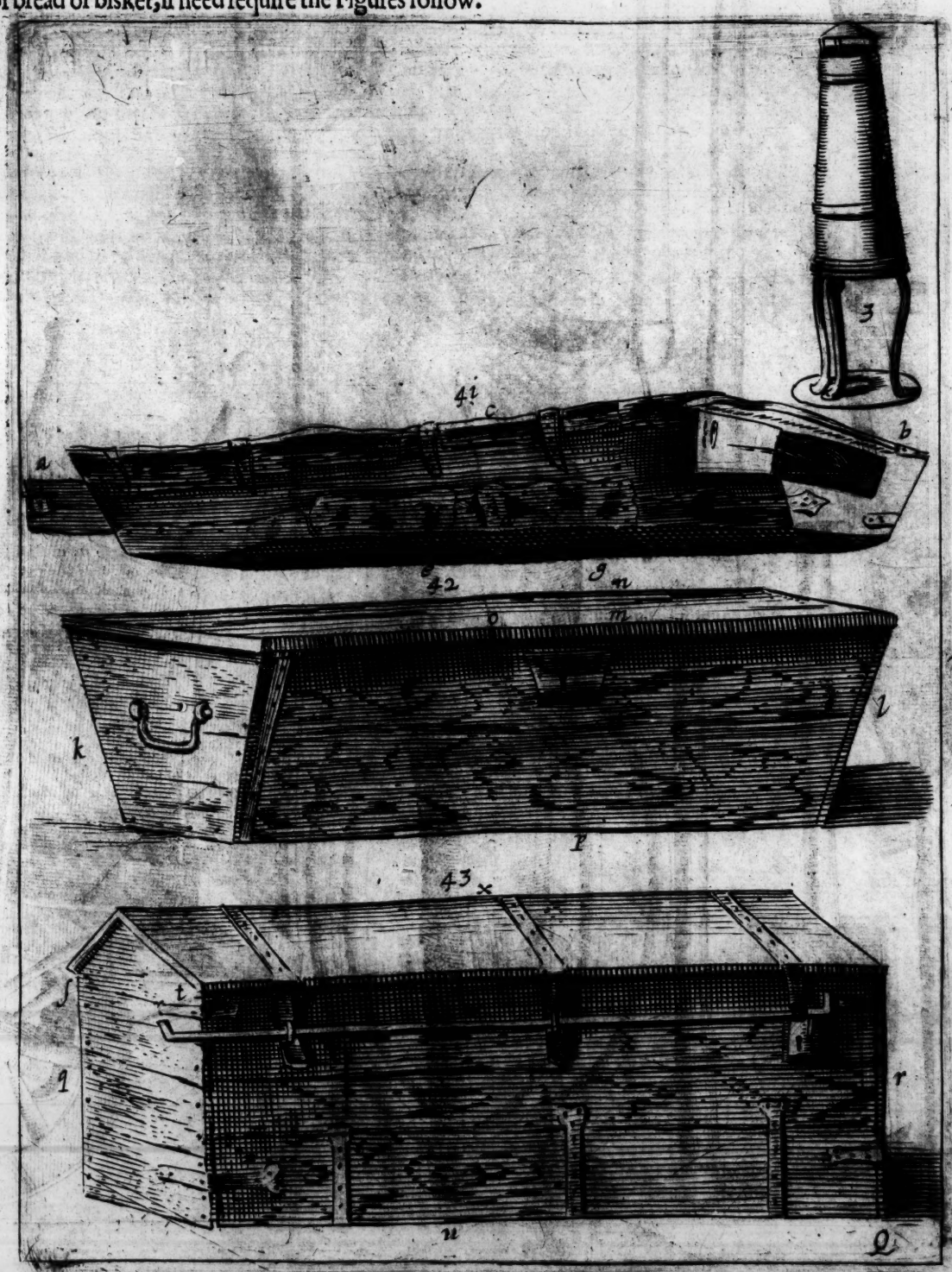
THE DEMONSTRATION OF A COPPER OVEN,

A Kneading Trough, and a bread cheſt, with the appurtenances thereunto belonging.

NUmber 41. is the figure of a new invented Copper Oven, ſet upon three Iron chimnies for the baking of bread for an Armie, having at both ends two mouths or doores, which opens and shuts, whereof the length of one of them from *a* to *b* is nine foot long, the breadth from *c* to *d* is three foot, the heigth from *e* to *f* to the top is a foot and a half, and the bottome upon which the bread bakes marked *g h* is two foot and a halfe. This Oven (as is ſaid) ſtands upon three Iron chimnies noted 1. into which fuel and turf is put to heat this Oven, how many loafes, and pounds of bread it will bake in three houres, the liſt following will show you.

Number 42. is the figure of a Kneading Trough, which from *k* to *l* is ſeven foot long, and from *m* to *n* is two foot broad, the ledge or cover *o* is three foot high, and the bottome *p* is almoſt two foot broad, to this kneading trough, you muſt have water pailes dow knives, peeles, to draw out the batches of bread, and all other neceſſaries belonging to a Baker.

Number 43. is the figure of a Bread cheſt very uſefull in the warres for the carrying of Bread and Bisket upon a march, whereof the length from *q* to *r* is eight foot long, the bredth from *ſ* to *t* is foure foot long, the height from *u* to *w* is three foot to the Cover, and the roofe or Cover from *w* to *x* is likewiſe three foot high. This Bread cheſt being ſet up a waggon, and drawne with three luſtie horſes, will carry a thouſand, yea twelve hundred pounds of bread or bisket, if need require the Figures follow.



THE DEMONSTRATION OF MATERIALS VSED IN OVR WARRES FOR *the making of Trenches, Approches, Saps, and works of Fortification, as followeth.*

Numb. 44. is a short plated Shovell to work in a Sapp or in a Gallery.

Numb. 45. is a long plated Shovell.

Numb. 46. is an Iron Crow, or a Goats foot.

Numb. 47. is a Hatchet to cut wood with.

Numb. 48. is a Mattock.

Numb. 49. is a spade with plated iron.

Numb. 50. is a Sod-Spitter.

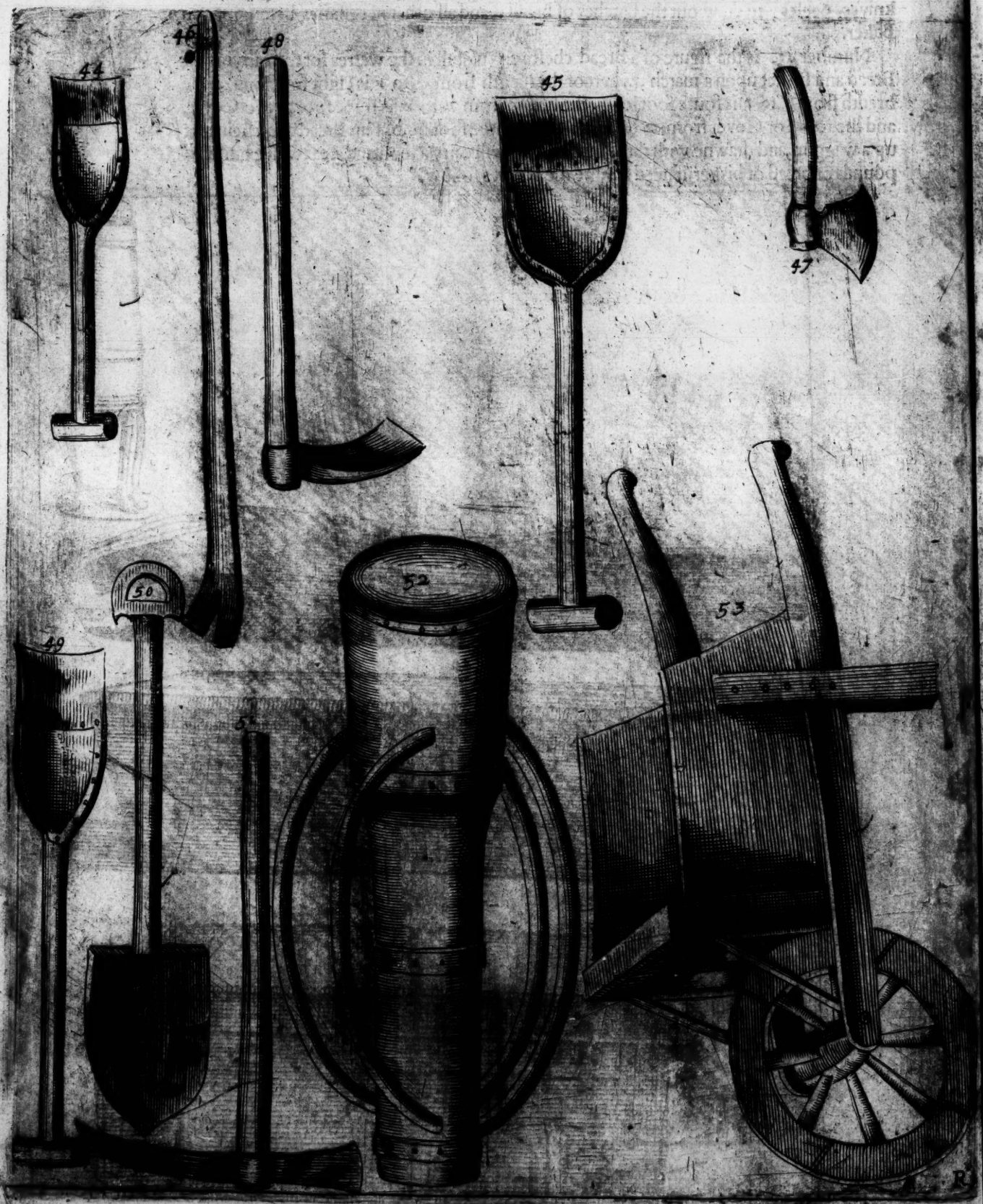
Numb. 51. is a Pickaxe.

Numb. 52. is a two handed Rammer to drive Palizadoes into the Ground.

Numb. 53. is a wheele-barrow to carry earth and Sodds in, for the making up of workes Palizadoes of two sorts you shall find in my second part in the chapter of Approaches. figure 166.

And Frize Ruyters or Turne-Pikes in the same chapter, figure 165. And foot angles or foot tanternailes in the same chapter figure 147.

All other warlike preparations, and necessaries you shall find in the list following.



The Office, and charge of the Generall, or Maſter of the Ordnance, and all other Officers *ſubordinate* vnder his Traine of *Artillerie* Munition, and Victuals, as the particular liſts of all preparations, and neceſſaries belonging to an Armie ſhall be here demonſtrated.

THe Generall or Maſter of the Artillerie (as is showne in my ſecond part of the chiefe officers of the feild pag. 9.) is a very honorable charge and hath command and ſuper intendencie ouer all the Ordnance, Armes, Munitions, Engines, Materials & Inſtruments for worke, yea, of all things belonging to the Ordnance, and hath alſo abſolute Commaund ouer all Inferiour Officers appartayning to the Traine of the Ordnance, as ouer the Lieutenant of The Ordnance, The Controuler, The Clarke, of the Amunition, and Materials, The Gentlemen of the Ordnance, and Maſter Gunners, Canoniers, Armores, Inginiers, The Captaines of the Pyoniers, and Mineurs, ouer all Smiths, Carpenthers, and wheel wrights, ouer all Artificers, and Handie-crafts-men, and all ſuch as doe attend vpon the traine of the Artillerie, Munition, and Materials. And when the Armie is to goe into the feild, he ſends his wartanrs and patents out to all officers vnder his Charge, to meete him at the Rendevous.

Now for the better helpe, and discharging of his office, he hath a Lieutenant of the Ordnance allowed him, who in his abſence hath abſolute commaund alſo ouer this Traine, and is giuen him as an aſſiſtant, to helpe him in the execution of his Commands.

And becauſe the Generall, or Maſter of the Ordnance, is commaunded in his Commiſſion, and perticular Inſtruction, to keepe a perfect account of all great, and ſmall peeces of ordnance, Equipages, Munitions, Materials, &c. he hath allowed him a Controuler of the Ordnance, which Controuler is obliged, and bound to keepe a pertinent liſt of all the peeces of ordnance great & ſmall in the Arſenals, and Magazines, belonging to the Land, regiſtring the weight of them, the Armes, and other things, that ſtand vpon them, as likewiſe what weight euery bullet is, which euery peece of ordnance doth shoote, who caſt them, how they came to belong vnto the Land, moreouer, to keepe notice of all Cariages, wheeles, plated, or vnplated, yea off all thingselſe belonging to the traine of the Artillerie, as maye appeare more at large in his Inſtruction.

Vnto this Traine of the ordnance there are allowed two Commiſſes, or Clarkes, one for all things appertainiug to the ordnance, The other ouer the Munition, Armes, Materials, Tooles, and ouer all other neceſſaris, belonging to the Armie, as ſhall appeare in the liſt following.

The Councill of State, having reſolued for the feild, they ſend for the Controuler of the ordnance, and giues him a liſt of all neceſſaries belonging to the Canon, where of the Controuler deliuers a coppie of yt to the Clarke of the ordnance, who receiues charge to take on certaine Conductours to the number of ſome 40, that by their helpe and care, all things contayned in the liſt, maye be in good order taken out of the Arſenals and Magazins of the Land, and to ſee them well embarked, or put vpon wagons to be brought with all expedition to the Rendevous appointed, and becauſe the Ordnance, Munitions, and Materials maye be taken out of ſeuerall Townes and Magazins, he gives to euery Conductour his charge in writting, to lade ſuch Ordnance, Munition, & Meterials, in thoſe places as he is appointed which they are to shipp, and bring them vp to the place deſigned, as they will enſwere to the contrarie, if any thing ſhould be loſt.

A Liſt, or Suppoſition.

What Ordnance, Munition, Matterials, and other neceſſaries, are vſefull to be carried into the feild with an Armie, as followeth.

IMprimes for batterie 6. whole Canons reinforced, 14 Demy Canons reinforced, 6 long Feild peeces, carrying a bullet of 6 lb. weight, 16 short Demy Drakes, of 24 lb. bullet, 12 quatre Canon Drakes of 12 lb. bullet, 12 short Drakes, or Sakers of 6 lb. bullet, & 14 ſmall Drakes of 3 lb. bullet making in all 80.

For 6 whole Canon ſpare Cariages, 6 for the 14 demy Canon Drakes 8 for the quarter Canon Drakes, 6. for the Faulconets, and ſaker Drakes 12, facit in all 29.

Spare Ship Carriages for theſe ſeverall peeces of Ordnance 20.

Spare wheeles proportionally for the Ordnance aboue ſpeecifyed of all ſorts. 20.

Fore-waggons, or Carriages 80.

Spare wheeles for the fore ſayd Carriages 22.

Block waggons & long waggons to lay, ordnance on, 25.

Spare fore and after wheeles 12.

Spare Thillers for the Block wagone 3.

Spare long waggons for the Blockwaggons 3.

Spare Axeltrees, and draughts 3.

Sledges, to draw ordnance on 8.

Fearnes, or windlaces compleat 8.

Eshellets, or martinets. 6.

Yron Crowes, or Goats feete, handspikes, and levers of all ſoorts. 20.

Braſſe pullies, or truckles 20.

Winches, or the Endleſſ ſcrewes 12.

Yron bolts. 10.

Spare kanns of Saleti oyle, for the Engines aboueſaid 6.

Tart, or greaſe boxſes, 25.

Spare hoggs-greaſe for the Carriages. 1300.

For every peece of theſe Ordnauce aboueſaid, three ladles, three Rammers, and 3 ſponges a peece facit 240.

Spunge Copper nailes 1200.

Sheepe skinnes, to make ſpunges off 400.

Wooden levers for the Ordnance 50.

Yron Crowes 20.

For 6 whole Canons bullets of 48 lb. 2000.

For 14 demy Canons, bullets of 24 lb. 3000.

For 6 feild peeces, or demy culvering of 12 lb. 1500.

For 16 Faulcones of 6 lb. bullet 1000.

For the Demy-Canon Drakes of 24 lb. 2500.
For the quarter Canon drakes of 22 lb. 2100.
For the Sakers of 6 ib. bullet 2100.
For the ſmall drakes of 3 lb. bullet 2200.
The Gabinen and Canon baſſketts, are made in the Feild, ſome 6. or 6. and a halfe foote high, and 3. foote in dyamiter, and coſts 18. ſts. d'peece Latton, Boxſes for the cartredge shoot for every peece 100. facit in all 4000.
Powder for theſe 80 peeces of ordnance 400000 lb.
Match in Bundles 300000.
Pouch-Barrils for the charging of ordnance with each a wodden hammer, and his dich 80.
Haire-cloaths 100.
Hurdles to plant ordnance on which are ſtiff 500.
Hand Barrowes 50.
Muskett Baskets of all ſoorts. 1200.
Woodden hoockes 20.
Thiller Harnaſe compleate 150.
Spare roapes & other harnaſe. 150.
Plated croſſe ſtaves for the drawing roapes after every couple of horſes 189.
Whip cord to binde with all 1000 paire.
Horſe collars. 800.
Drawing roapes of 40 fadome a peece 30.
Half drawing roapes 30.
Steering-roapes 60.
Windlaſſe Roapes 8.
Strycking roapes 8.
Drawing lines 70.
Neck lines to drawe up shipping, or uſe full about ordnance 40.
Ramming blocks to drive in piles, in the ground 12.
Small Rammers to drive in piles 10.
Spare roapes 12.
Great Yron hammers 7.
Beames, and underlayers for plat-formes, and other vſes. 10. foote longe 500.
Planckes for bedding & other vſes 4000.
Sparres 6000.
Spades 1000.
Showells 2000.
Axſes 500.
Hatches 500.
Hand billes 500.
Pick axſes 300.
Mattocks 300.
Yron hammers for the Greaeers of ordnance 12.
Lanternes 30 lb.
Candlet 300.
Frie-lights to putt in pitcht roopes 20.
Leather pailes to quench frie with all 30.
Canvas peeces, to make blinds with 30.
Pack thred 20.
Saile yarne 4 lb.
Firkins of ronnd pitcht roopes 12.
Bolts, and clenchers for the Axeltrees of Carriages, and the Block-waggons 60.
Bolts for the Thiller carriages 60.
Bolts and clenchers for the long waggons 60.
After hookes for the carriages 20.
After Nailes 50.
Spare clenchers and wedges for the ordnance 40.
Wedges for the block and long waggons 100.
Small sheires, with bolts and rings 100.
Shieres with chaines 30.
Nailes for the bolts 150.
Great yron Nailes 150.
Yron Staples 100.
Latton Boxſes with cartriedge shott 1000.
Towe of diverſe ſorts 100 lb.
Bundles of roapes and Cordage 10.
Nailes 8 ynches long 600.
Nailes 7 ynches long 2000.
Nailes 6 ynches long 6000.
Nailes 5 ynches long 12000.
Double ſized nailes 20000.
Single ſized nailes 20000.
Small nailes and lath nailes of all ſorts 20000.
Bundles of barre yron 400 lb.
Plate yron, and small barres for ſmiths 3000 lb.
Of ſtaue ſteele 1000 lb.
Item all ſmiths Tooles, and vtenſiles.
All Carpenrers Tooles, as many as shalbe need full.
Two great Morters, mounted vpon their Carriages.
One ſmall Morter for each 100 granades of 160 lb. for the great, and 100 granadoes of 20 lb. for the eſſer.
Hand granadoes to caſt into ſaps, trenches, and workes.

A liſt of ſome other

Materials, and neceſſaires, which the Clarke of the Materials vſes to carrie with him to the Feild, to make a *Magazine* of in the Army as followeth.

Powder for Muskettiers 500000 lb.
Match in Bundles 80000.
Sow-lead to caſt muskett bullets with 50000.
Moulds of 12 bullets a peece to caſt in 50.
Haire-cloaths to cover the powder with 60.
A Great many of old peeces of ſailes to make blinds with 1000.
Spare Muſketts 500.
Spare Muſket reſts 1000.
Spare Bandeliers 500.
Spare Muſkett ſtockes 300.
Pikes 16 foote long beſides the head 2000.
Half-Pikes with Loops ſtaue-feete 300.
Corſlets, and Head peeces 300.
Armors of proofe with Caſkets of proofe 100.
Iavelines double pointed, with yron to putt through the tres of Turnepikes 1500.
Match-Hornes to blinde light matches vpon an enterprize 3000.
Running waggons with two wheeles, and Iavelins put through the Axeltres 300.
Short Paliſſadoes *to driue into the ground with long tenter nailes 6000.*
Yron hammers to ſtrick the nailes in 50.
Wodden hammers to breck open the barrils of powder 200.
Great Boorers to boore holes with 9.
Twelue firkins of foote angles, or foure ſquare tenter nailes 12000.
Yce ſpurrs with lachets 6000.

Peeces

Peeces of Bulrush bridges for an Enterprise to passe ouer a moate, or ditch 150 peeces.
Hand-barrowes to carry sodds 150.
Shippers hookes short and long 150.
Long yron rakes with 3 or foure teeth 150.
Great Beetlets 1000.
Water scupps 200.
Mathematicall water horse miles, to drayne out water, se figure 37. 3.
Spiters to spit sodds with all 300.
Bagger Netts to worke in a gallery 25.
Crooked yron Showels, with long hafts to worke in a Gallery 12.
Spades 10000.
Showells plated. 2000.
Mattocks 1000.
Pickaxses 600.
Great yron hammers to breake stone walles with 100.
Axses of all sorts 1200.
Hatchets and Hand bills 100.
Great Pincers 8.
Great and small hammers 38.
Tron crowes of all sorts 30.
Draggs 25.
Nailes both greate and small enenuto lath nailes of all sorts. 200000.
Lanterns and blinde lanterns of all sorts 40.
Candles 400 lb.
Torches 50s.
Fire-lights 25 and pitch roapes 600 peeces.
Barrils of pitch 6.
Barrils of Tarre 4.
Woll-sacks 200.
Howerglasses 50.
Vntempored chaulk in barrils 4 last.
Ship-Katroles of all sorts 220 single.
Double Ship Katroles 70.
Drawing lines to draw Shipping against the streame 60.
Baggs to fill earth withall vpon an Approah 2000.
Ammunition chests to put them in 6.
Blinds of Kanuas 150 foote long each peece 200.
Plancks, Sparrs, Heames of all sorteg ood store for ordnance, palissadoes, galleries, and other workes, some shorter, and some longer as occasion maye serve.
Great block pile-driuers, with al their roepes, and appurtenances 2.
Tow-handed Rammers for two men to driue in pallissadoes with 20.
50 peeces of bulrush bridges, couvered ouer with Kanvas, with their ropes, & coards to fasten them one to an other and ankors each peeces being 10 foote long, & 6 foote broad, Corke bridges each bridg contayning 10 peeces ioyned to gether, & each 10 foote long 2.
Cordage of all soorts 400 lb.
Windlases or winches 2.
Leather pailes to quench fire with 300.
Handsawes, two handed sawes, and great timber sawes 250.
Augers of all sorts, Wimbles, & Adases 50.
Good store of Carpenters.
All things necessarie for 100 Karres, to carry earth in compleate wheele Barrowes 2000.
Spare wheels and yron pinne for them 500.
Single sawne plackes for the wheele barrowes 200.
Quarter staues, or great Beacons to lay out the quarters with all with flaggs 200.
Haspels, and Turne-pikes, with their Iavelins small and great 100.

By this List abouesaid, one maye eassely vnderstand, what Munitions, Materials, and necessaries are need full to be carryed into an Armie, of all which the Clarks of the Amunition, and the Materials shall deliuer them out by the helpe of their Conductors, as the occasion of the maye service reqnire, and also receiues them into their Custodie againe.

The Waggon Master Generall, his Lieutenant, and Conductours march vnder the Traine of the Ordnance.

BEfore the Armie rises to the Feild, the Lord Generall sends out Writs for the Waggon Master Generall, that he shall send for his Conductours, to presse and take, vp so many Waggons, as the greatnesse, or litleness of the army maye require, it maye be in every quarter 6, 7, 8. yea 1000. Waggons, and each Waggon to be furnished with three lastly horses, and a dryver, every Weggon having 3 gilders a day, so long as the Armie is in the Feild, and the Conductours 30. stivers per diem.

A Liſt of the Waggons to beemployed as followed.

First for the Generall of the Ordnance his Traine 150.
For the Lord Generall him ſelf, as many as his traine ſhall require.
For princes Earles, and Lords voluntiers as many as they ſhall have vſe for.
For the Lords the Deputed States for the Armie as many as they have vſe for.
For the Clarke of the Munition, and his traine Ineluding alſo the Controuler, Inginiers and Conductour two compaines of Pyoniers, and the Carpenters 120.
For the Sariant Majour Generall of the Armie 2.
For the Commiſſe or Klark of the Victuals and his traine 320.
For the Quarter-maſter Generall of the foote 2.
For the Provoſt Marshall Generall 3.
For the three principall Chiurgians of the army 3.
For the Treaſurer of the Armie 3.
For the Waggon-Maſter Generall, his Lieutenant, Conductours, Wheele-makers, Smiths, & Tow-workers 7.
For the Quarter-Maſter of the Horſe 1.
For the Lieutenant Generall of the Horſe 6.
For every Colonell of the foote ſome 3 ſome 4, according to the greatneſſe of their traine, A Lieutonant Colonell 1.
For every Sariant Majour 1.
For every Quarter-Maſter of the foote 1.
For the Preachter of a Regiment 1.
For every foote Companie in the Armie 1.
The Bridgmaſter hath vnder his charge all ſorts of punt bridges & ſmall boate bridges: the ordnance and all things elſe carried vp to the Rendevous in punts.
The Commiſe Generall or Clarke of the shipping when the Armie is to goe into feild is to ſend forth two Conductours to preſſe ſo manye Ships in every Towne and quarter, as the Generall ſhall give hrm order for, and as the greatneſſe of the Armie maye require.

A Liſt of the Baggage Shipps, and for all Officers that followes the Army.

For every Colonell and the chiefe Officers of his Regiment Ships 3.
For every troupes three of horſſe 1.
For the Lord Generall and his traine 21.
For the Lord Marshall 5.
For forrain Lords and Earles 23.
The Quartter-maſter & the Provoſt goe in the Ship appointed for the Officers of the feild
For each Captaine of the Pyoniers a Ship 3.
For the Theaſuier of the Army 1.
For the Advocate Fiſcall & his Recorder 1.
For the chiefe Maſter Gunner 1.
For the Captaines of the Carpenters 2.
For the Provoſt Marshall Generall 1.
For the Generall of the Ordnance 1.
For the Klarke of the Immunition 1.
For the Klark of the Ordnance 1.
For the Klarke of the Victuals 1.
The Waggon-Maſter Generall 1.
The Captaine of the Kanon Horſes 1.
The Commiſe or Klark of the Shipping 2.
The Sariant Majour Generall of the Army 1.
The Quarter-Maſter Generall 1.
The Controuler of the Artillerie & Munition 1.
The Controuler of the Fortifications 1.
The Inginiers, and their Aſſiſtants 1.
The Provoſt Marshall ouer the Shippers, and ſaylours 1.
Ships allowell for the tranſporting of ſick and wounded ſouldiers 20.
Spare Ships for forraine Lords and Voluntiers 10.
For the Provoſt Marshall Generall of the Cavaillerie 1.
For the Phyſician and Apothecarye of the armie 1.
Beſides all theſe every Companie ſo long as they lye a Ship board have three, foure, or fiue Ships comming out of garriſon till they march a land, where of ſome of theſe Ships have three gilders, ſome a tixe dalder, others two gilders a day, according to their burden.
The Commiſſe or Klark Generall ouer the Victuals, hath ſuperintendence and care ouer all manner of Victuals, as alſo Victuallers and Sutlars, which followes the Armie, and hath vnder his charge diverſe Conductours, and Bakers as the ſervice maye require.
Firſt if be a long expedition, ſo that noe bread, or Victualls can come vp to the Army from the Shipping by convoy, or to any

to any towne beſeiged it wilbe needfull for him to have meale barriled vp 156 lb. in a barrill 3000 barrils
Which 3000. Barrils will require 600 waggons.
For the keeping of it in Shipping before it be loaded on waggons he muſt have 5. Conductours, and Ships 9
All neceſſaries muſt he have alſo belonging to Bakers, and Bakers.
As alſo 40. Kopper Ovens ſuch as yow ſee figure 47. each oven carryed vpon a waggon, Troughs, dowknits, pailes
For theſe 40. Kopper Ovens ſixe great kitchin tents, with two or three chimneies in them.

Now one Oven being 9. foote longe, and 2½ in breath, wil bake in three howers a batch of 50. long loaves of bread each loafe a foote long, & 5. ynches broad, which bakes at a time, 300 lb of bread, and one Oven will bake in 24. howers 300 loaues of bread, which makes 1800. lb.
And 40 of theſe ovens being well heated, will backe 6. times in 24. howers, 12000. loaves, which at 4. lb. each loafe, comes for one day to 48000. lb. and for two dayes if the Armie reſts 96000. lb. a reaſonable proportion of bread 960000 lb.
Item chieſe for the Army in ſtore 500000 lb.

9

The

Demonſtration for the Quartering of the Generall, or *Maſter of the Ordnance*, and all Subordinate Officers marching vnder the Traine of the Artillerie.

FIrſt this Quarter is in breadth, or Front from A. to B. 600. foote, and from B. to C. is 300. foote in Depth, which never takes vp any more ground in Depth, but onely the Ordinary meaſure, for all the ſtreets in yt, are but 20. foote broade, and are marked D.E, & is the *Parke* or *empalement* of the Generall of the Ordnance is ground, with his *Attendants*, men, and *Horſes*, as yon maye evidently ſee in the raized Figure.

Num. 1. is here a *Parke* or a ſquare of 100. foote: In which parke his Tents, and Meaſures are ſett vp as the firſt is as followeth, a Hall or place of 12 foote in ſquare, and a Gallerie beyound that, and the great Hall of 6 foote long, and 6 foote broade. The great Hall ordyning roome is 24. foote broade, and 12 foote deepe. The two *Pavillions* are 12 foote ſquare. The Gallerie reaching from the one *Pavillon* to the other is 20 foote long, and 6 foote broade. The Gallerie from the great Hall to the gallerie of the two Pavillions is 10 foote long, and 6 foote broade. The Curtaines of the Tents are all of them ſixe foote deepe, and the two firſt Pavillions are likewiſe 12 foote ſquare, and the Kitchin is 24 foote long, and 12 foote broade.

F. Is the parke, or quarter of the Lieutenant Generall of the Artillerie, and for the Maſter Gunners, and Gentlemen of the Ordnance, their ſervants, & Horſes, which park is 100 foote broade, and 40 foote in depth. The Tents of the Lieut. Generall, are of this Meaſure following. The great Hall is 16 foote in depth, & 10. foote broade. The Gallerie 6 foote long, & 6 foote broade. The Pavillions are 8 foote in ſquare.

G. Is the parke for the Matterials of Amunition, as ſpades, ſhowelles, Hatches, Billes, Axes, Pickaxſes, Mattocks, planckes, beddings for Ordnances, beames, wheele barrowes, and diverſe other things. This parke is 140 foote in depth & 130 foote broad.

Number 5. is the Hutt, or a Tent for the Clarke of the Matterials.

Number 6, is a Hutt, into which all things are layd, which muſt not take wett. As Match, candles, and other things.

Number 7. is a Common Kitchin for all the Conductours, to dreſſe their victualls in, and made there to keepe the quarter from fyring.

Number 8 are the Conductours Hutts, ſome 8 or 10 foote in ſquare.

H. Is the parke into which are layd, all the materialls, inſtruments, & tooles belonging to the Ordnance, as alſo anckours, powder, and bullets, & diverſe other things, which parke is 140 foote in depth, and 130 foote in bredth.

Number 1. is the Tent or Hutt of the Clark of the Ordnance.

Number 2. is a Hutt with all manner of Amunition, belonging to the Ordnance, which ought not to receiue wett.

Number 3. is the Common Kitchin.

Number 4. is a Cave, or Sellar to laye in Gun-powder.

Number 8 are Hutts for the Conductours of the Traine,

I. Is the park or quarter for the Maſter Gunners, or Gentlemen of the Ordnance the ordinarie Gunners, & Caponiers whoſe depth is 70 foote, & 40 foote broade.

K. Is the parke or lodging of the Maſter of the fire workes, with his Conductours, & men, whoſe parke likewiſe is 70 foote in depth, & 40 foote in breath.

L. Is the parke, or quarter of the Petardiers, and their men, which is alſo 70 foote in depth, & 40 foote in breath.

M. Is the parke of the Maſter of the Batteries, & his men of the ſame greatneſſe.

N. Are three tents, or hutts for the Captaines of the Saylours, & marriners to attend vpon the Ordnance, the Attiralls, & drawing harnaſſes for the Ordnance and for the Mineurs.

O. Are all hutts 8 foote in ſquare, each for two Saylours, and two Mineurs, The ſreetes alſoo betweene every row of hutts is 8 foote broade.

Their quarter is 140 foote in depth & 90 foote in breath.

P. Is the parke, or quarter of the Clarke of the Fortifications, and his Conductours, being 60 foote in ſquare.

Q. Is the parke and quarter of the Inginiers, & their Conductours, being 80 foote in depth, & 60 foote in breath.

R. Is the quarter-maſter of this traine his quarter, or lodging being 60 foote in ſquare.

S. Is the parke or quarter of the Captaine of the Canon, or drawing Horſes, and his Conductours, being alſo 80 foote in depth, & 60 foote in breath.

T. Is the quarter, or parke for the makers of Gabions, or Canon baskets, & Musket baskets, being 40 foote in bredth & 60 foote in depth.

V. Is the Armourers parke, & the quarter for the General of the Ordnance, with their workemen. Farriers, & Smiths belonging to this Traine, being 60 foote in depth, and 30 foote in bredth.

W. Is the Chirurgians parke of this Traine, 60 foote in depth, and 20 foote broad.

X. Is the Provoſt Marſhall of this Traine, 60 foote in depth, & 30 foote broade.

Y. Is the Farriers, or Maſter Smith his parke 80 foote in depth, & 25. foote in bredth.

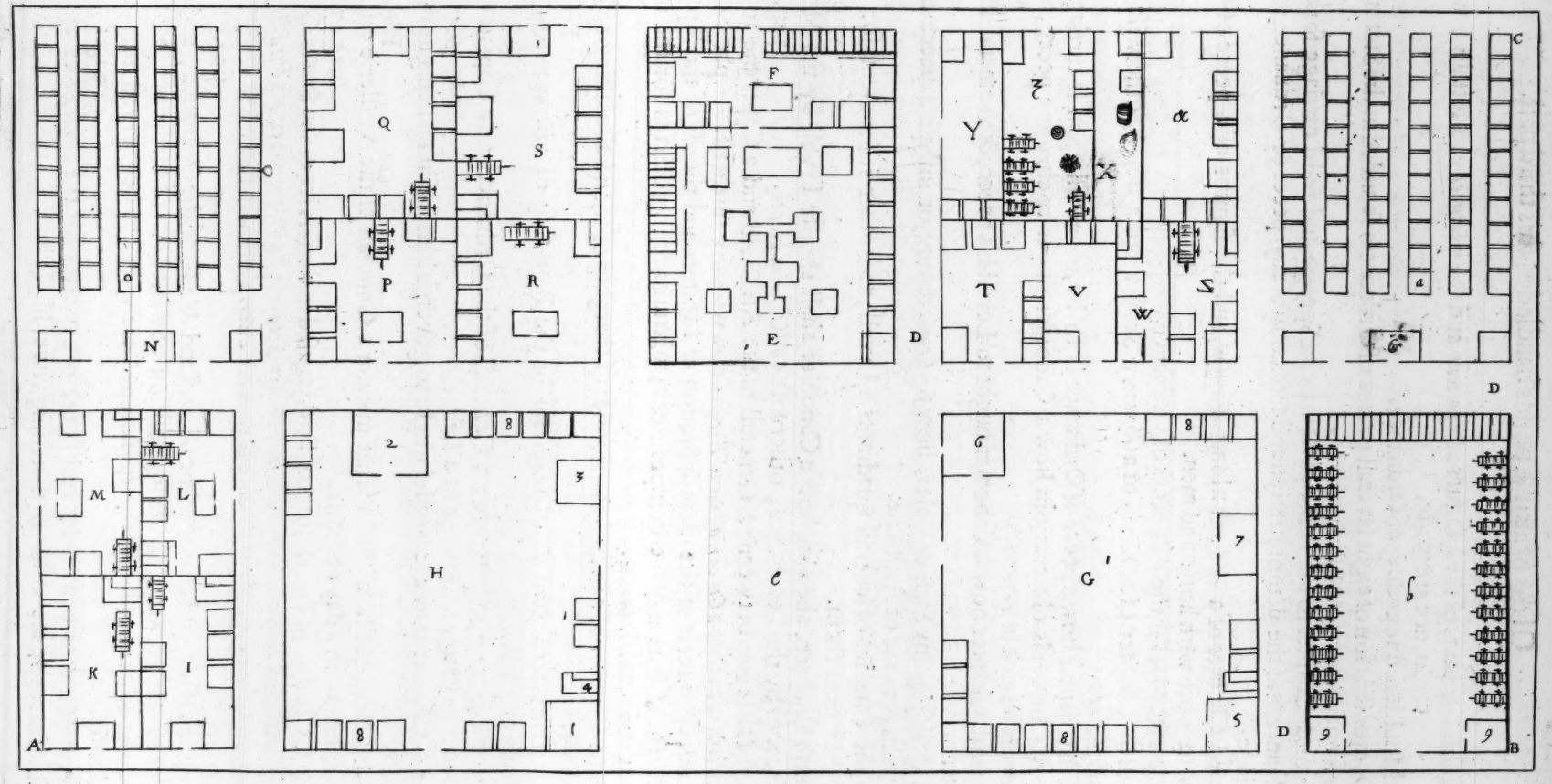
Z. Is the Carters or Waggon mens and labourers, 80 foote deepe, and 35 foote broade.

a. Is the Coopers parke 80 foote in depth, & 25. foote in breath.

b. Is three Hutts or Tents for the three Captaines of the Pionniers, a. are the Hutts of the Pionniers with their Lieutenants, whoſe hutts, are in the front of the rows, and each Hutt is 8 foote in ſquare, whoſe parke is 90 foote in breath, & 140 foote in depth.

6. Is the parke, where in is ſett the carriages of Waggons, & drawing Horſes for the Ordnance, which is to be vnderſtood ſuch as are to paſſe vpon the watch, and Canon for any ſuddaine peece of ſervice, & to thend, the horſes maye not be then to ſeeke. The two Hutts within the parke marked 9. are for the Conductours & waggon Men. This parke is 140. foote in depth, & 80. foote in breath.

Thus much for the Geometricall modell of a quarter for the Artillerie.



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